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FNCV DIARY OF COMING EVENTS

GENERAL MEETINGS

Monday, 11th February, 8.00 p.m.

Dr. Neil Hallam. The biology of Macquarie Island.

Monday, 18th March, 8.00 p.m.

Extraordinary meeting: Motion — That The Basin Junior Field Naturalists Club be elected as an affiliated Club of the Field Naturalists Club of Victoria.

Dr Tom Rich. Australian Mammalian History. NOTE CHANGE OF DATE AND SPEAKER.

Monday, 15th April, 8.00 p.m.

Stephen Forbes. Plants of the Kimberleys.

New Members — November/December, 1984 General Meetings.

Metropolitan

Elizabeth Balogh, 1/44 Lower Dandenong Road, Mentone.
Tim Barlow, 298 Aqueduct Road, Diamond Creek.
Murray Haby, 24 Wellman Street, Box Hill South.
Frank Leach, Lot 5 Wellington Road, Lysterfield.
Jennifer Livingston, 50 McConnell Street, Kensington.
Keith Opie, 24 Hornby Street, East Brighton.

Joint

Sylvia and Stephen Bowden, 135 Spensley Street, Clifton Hill.
Daryl and Margaret Gerwin, 21 Findon Avenue, North Caulfield.
Noel and Enid Schleiger, 1 Astley Street, Montmorency.
Russell and Barbara Ward, 46 St. Hellier Street, West Heidelberg.

Country

Raymond Jasper, 188 High Street, Rutherglen.

FNCV EXCURSIONS

Saturday-Monday, 9-11th March. Victorian Field Naturalists Clubs Association weekend at Mornington Peninsula hosted by the Peninsula F.N.C. Tentative programme as follows: Saturday, 9th March, 1.30 p.m., meet at Adam Clarke Village, Baxter (off Flinders Road) for excursion to Mooroodue Quarry and Sweetwater Creek Reserves. 7.00 p.m., A.G.M. at hall in Adam Clarke Village. Business should conclude about 7.45 p.m. and will be followed by a social evening with an illustrated talk on the local area, and supper. Sunday, 10th March. Depart from Village for Flinders beach at 9.00 a.m., then on to Bushranger Bay Track car park in Boneo Road about 10.30 a.m. After lunch we go on to Cape Schanck, then on to Pines picnic area about 3.00 p.m. Return via Arthurs Seat. At 7.45 p.m. there will be another get together at the hall and Mr. J. Weir, Marine Biologist, will be the speaker. Monday, 11th March. Depart 9.00 a.m. for a marine biology excursion to Shoreham. Leave for home early afternoon. There will be a coach leaving Melbourne 9.30 a.m. Saturday from the Gas and Fuel offices in Flinders Street, and motel accommodation R.O. has been booked in Frankston for the coach party. Cost for coach and motel will be approximately $85 and bookings should be made with Marie Allender, Excursion Secretary, accompanied by $20 deposit. There should be spare seats on the coach for members who do not require accommodation at the motel. There is a caravan park in Robinsons Road, very close to Adam Clarke Village with some on-site vans — phone (059) 71 2333. Members camping should make their own bookings. These weekends are a great way to meet other naturalists so come if you can, even if only for part of the time. Bring picnic lunches.

Sunday, 31st March. Pirianda Gardens. The coach will leave Batman Avenue at 9.30 a.m., fare $9.00. Bring a picnic lunch. This replaces the usual day excursion in April as the first Sunday is Easter Sunday.

Friday-Tuesday, 5-9th April. Easter. Hawthorn Junior's camp at Beechworth and Mammal Survey Group camp in the Big Desert. Contact the relevant secretaries for details.

Sunday, 5th May. Blackwood. Leader: Graham Love. This is an historic mining area with a variety of natural history interests. Details next Naturalist.

Preliminary Notice: September. Consideration is being given to an excursion to Queensland including Noosa Heads, Rainbow Beach and Fraser Island if sufficient members are interested. Please let the Excursion Secretary know if you would like to go on such an excursion.

GROUP EXCURSIONS

All FNCV members, and visitors, are invited to attend Group Excursions.

Botany Group.

Saturday, 23rd February. Lake Mountain.
Saturday, 23rd March. "Forest Trees". Leader: William Ashburner.
Saturday, 27th April. Kawarra Native Garden and Ferns of Olinda Forest.

Mammal Survey Group.

April 5th-9th (Easter). Big Desert Wilderness.

Geology Group.

Sunday, 17th March. South Morang.
Sunday, 14th April. Warrandyte.

GROUP MEETINGS

FNCV members, and visitors, are invited to attend any Group Meeting.

Day Group — Third Thursday.

Thursday, 21st February. Visit to Craft Cottage, then guided walk on Australian Aboriginal Plant Resources. Meet at Botanic Gardens Kiosk at 11.30 a.m. Leader: Mr A. Blackburn 379 8960.
Thursday, 21st March. Port Melbourne—Albert

(Continued inside back cover)

F.N.C.V.

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Cover Illustration: White-footed Dunnart *Sminthopsis leucopus* (Photo: R. Forse). See article on page 4.

Mammal Survey Group Contribution No. 14.

The Mammals of Gellions Run, South Gippsland

BY L. F. LUMSDEN* AND M. SCHULZ*

Summary

A mammal survey of Gellions Run, South Gippsland, Victoria, was conducted between 1976 and 1982 by the Mammal Survey Group of the Field Naturalist's Club of Victoria. Eighteen native mammal species (one monotreme, ten marsupials, four bats and three rodents) and six introduced species (two rodents, two carnivores and two lagomorphs) were recorded. The habitat and relative abundance of each species is discussed.

Introduction

Gellions Run is an area of natural bushland of approximately 3200 ha. on the coastal plains of Corner Inlet west of the Albert River estuary, South Gippsland (Fig. 1). The study area is isolated from nearby forest by grazing land to the north, west and east, and by Corner Inlet to the south.

The survey was conducted to determine the species of mammals present and their broad habitat preferences. It was initiated to assist the Land Conservation Council (LCC) to prepare recommendations on crown land usage in South Gippsland.

In the LCC final recommendations (LCC, 1981a; LCC, 1982), the area north and west of Telegraph Road (see Fig. 1) has remained uncommitted land until the Government has determined plans for the utilization of the economically viable seam of brown coal which underlies much of Gellions Run. The area south and east of Telegraph Road has been recommended to become part of the Nooramunga Marine and Wildlife Reserve.

* Mammal Survey Group, Field Naturalist's Club of Victoria. C/- National Herbarium, Birdwood Avenue, South Yarra, Victoria.

The mammal fauna had previously been surveyed as part of a vertebrate fauna study of the South Gippsland region (Norris *et al.*, 1979). From this work Mansergh and Norris (1982) identified Gellions Run as a site of regional zoological significance.

Description of the Study Area

Physical Description

Gellions Run is situated in the Alberton Depression and its boundaries lie within the Gelliondale brown coal field. It is characterised by sand dunes originating as Pleistocene sedimentary deposits. The soils are largely sandy loams with patches of peaty swamp soil in the depressions. Further details of the geology and geomorphology of the area are provided by LCC (1980).

Climate

The climate of Gellions Run is typical of that of South Gippsland. Precipitation occurs throughout the year with the highest falls in spring and winter. Mean rainfall (at nearby Port Albert) is 709 mm per year (LCC, 1980). Temperatures are highest in late summer and lowest in

Plate 1. Saw Banksia woodland with an understorey of Austral Grass-tree.

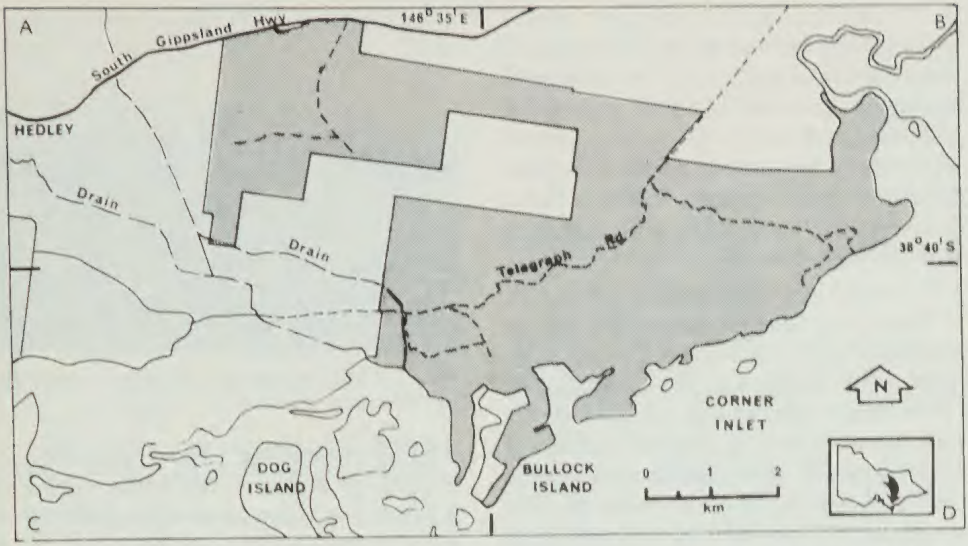

Fig. 1. Location map of Gellions Run. A, B, C and D indicate the five minute grids referred to in Table 3.

winter. Detailed climatic information is provided by LCC (1980).

Vegetation

There are five broad structural vegetation types in Gellions Run (LCC, 1981b). The factors underlying the differences in these vegetation types are, primarily, height above sea level and the consequent effect on water table depth, rather than any major differences in soil composition. The vegetation types are outlined briefly below and are shown on Fig. 2. More detailed information may be found in LCC (1980 and 1981b) and unpublished Mammal Survey Group records.

a. Woodland (Plate 1)

This is the most extensive vegetation type present in the study area. The dominant tree species are Manna Gum (*Eucalyptus viminalis*) and Saw Banksia (*Banksia serrata*) with scattered Messmate (*E. obliqua*) and Narrow-leafed Peppermint (*E. radiata*). The intermediate layer is sparse, consisting of Sallow Wattle (*Acacia longifolia*), Blackwood (*A. melanoxylon*), Cherry Ballart (*Exocarpos cupressiformis*) and young canopy species. The shrub layer varies in density, being thickest in depressions, and is dominated by Silver Banksia (*B. marginata*), Prickly Tea-tree (*Leptospermum juniperinum*), Silky Tea-tree (*L. myrsinoides*), Spike Wattle (*A. oxycedrus*) and Prickly Moses (*A. verticillata*). The ground layer of grasses and herbs, up to 1.5 m high, varies from sparse to moderately dense. Common species include Austral Grass-tree (*Xanthorrhoea australis*) and Austral Bracken (*Pteridium esculentum*).

b. Closed-scrub (Plate 2)

Closed-scrub occurs along the inland edge of the coastal plant community, around swamps and in low-lying depressions. The dense shrub layer is dominated by Swamp Paperbark (*Melaleuca ericifolia*) and Scented Paperbark (*M. squarrosa*). The ground cover is sparse and consists of a variety of small herb and sedge species.

c. Wetland Community (Plate 2)

Inland swamps range from open water to dense reed beds of the reed *Phragmites communis*. Other common species include Water-ribbons (*Typha* sp.) and various sedges.

d. Heath (Plate 3)

This vegetation type occurs mostly in the northern section. The dominant species are Scrub She-oak (*Casuarina paludosa*), Prickly Tea-tree, Swamp Paperbark, Scented Paperbark, Austral Grass-tree and Yellow Hakea (*Hakea nodosa*). The heath varies in height from half to two metres.

e. Coastal Plant Communities (Plate 4)

There are four broad bands in this community, commencing at the sea edge with pure stands of White Mangrove (*Avicennia marina*). A predominantly monotypic stand of Beaded Glasswort (*Sarcocornia quinqueflora*) extends inland in a band averaging 8 m wide. This is followed by a broad zone (up to 40 m) of Beaded Glasswort and Shrubby Glasswort (*Sclerostegia arbuscula*). On higher ground in damp situations, rushes (*Juncus* sp.) are dominant with Knobby Club-rush (*Scirpus nodosus*) and Spear-grass (*Stipa* sp.) occasionally present. In drier situations Spear-grass is dominant with scattered stands of Chaffy Saw-sedge

Plate 2. A reed bed swamp and area of closed-scrub, surrounded by Manna Gum woodland.

(*Gahnia filum*) and rushes. This zone is variable in width. At the western drain it forms an extensive band while elsewhere it averages less than 15 m wide.

Methods

Between 1976 and 1982 there were ten visits to the study area, encompassing all seasons of the year and sampling the five major habitat types. At each trapsite and spotlighting area, the habitat was described, using the classification

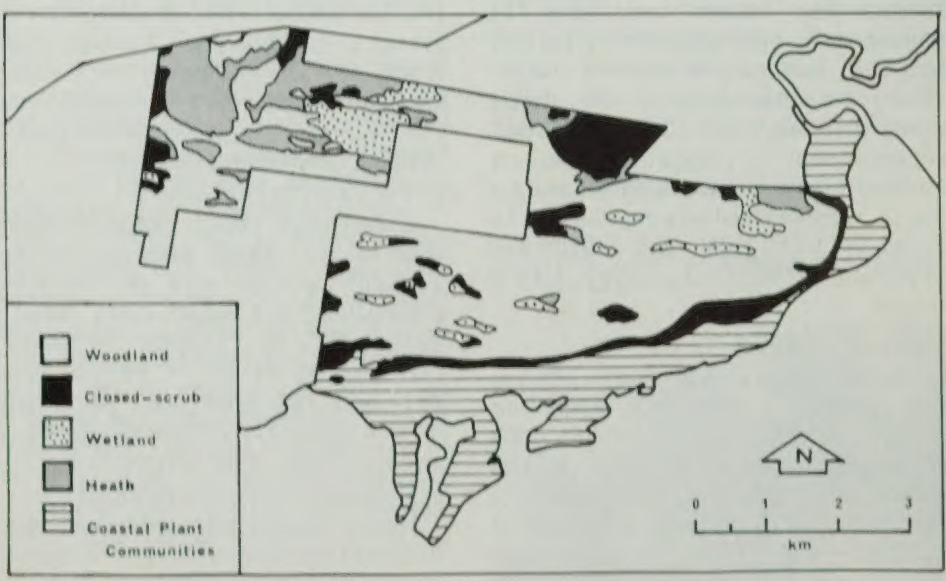

Fig. 2. Vegetation types in Gellions Run (modified from LCC 1981b).

developed by Specht (1970). A number of survey techniques were employed

a. Small mammal live traps

Wire cage traps (16 x 20 x 36 cm) and collapsible Elliott traps (9 x 10 x 32 cm) baited with a mixture of peanut butter, rolled oats and honey were used to sample populations of small ground-dwelling mammals. Results from the two types of traps have been combined. During five of the visits consecutive night trapping, of up to three nights, was possible

b. Spotlighting

Spotlighting was conducted by foot between dusk and midnight on eight of the ten visits

c. Pit trapping

Pit traps with drift line fences were used on three visits. Metal cylinders or 18/ drums were placed into the ground and lengths of black plastic or flywire, straddling the pits, used as the drift fence. In October 1977 two lines of six pits and 50 m of drift fence were used for two nights, in March 1978 one line of six pits and 200 m of fence for two nights and in January 1981 ten pits and 60 m of fence were used for three nights. Pits were left unbaited and checked regularly

Plate 3. Heath in the northern section bordered by woodland

Plate 4. Coastal plant communities along the western drain

d. Bat trapping

Collapsible bat traps (modified from Tidemann and Woodside, 1978) were used on three visits during 1981-82. Mistnets (15 and 20 m in length) were used on four occasions between dusk and midnight. Trip lines (2.7 kg breaking strength fishing line) set over the surface of a small area of open water in a freshwater swamp, were used on one occasion

e. Other evidence

Daylight sightings, skeletal remains, scats, diggings and tracks were recorded. During some visits, searching under logs and other debris was undertaken in an attempt to locate trap-shy ground-dwelling species

Results

Eighteen native and six introduced mammal species were recorded during the survey. A total of 1968 trap-nights, 51.5 spotlight-hours, 66 pit-nights, 19 bat trap-nights, 30.5 mistnet hours and three hours of trip-lining were conducted. The number of each species recorded in the five habitat types is shown in Table 1. Table 2 outlines trapping and spotlighting success rates, and the survey intensity in the different habitat types. Trapping success was measured as the number of mammals trapped per 100 trap-nights, and the spotlighting rate as the number of mammals spotlighted per spotlight-hour. These figures do not represent densities and should be used only to compare habitats.

Table 3 presents the species recorded in the four, 5 minute latitude by longitude grids which encompass Gellions Run,

Table 1: Number of individuals of each species recorded in the five habitat types.

SPECIES	SCIENTIFIC NAME	HABITAT TYPES[1]					TOTAL NUMBER RECORDED
		1	2	3	4	5	
Short-beaked Echidna	*Tachyglosssus aculeatus*	5	1				6
Brown Antechinus	*Antechinus stuartii*	46		2	1		49
White-footed Dunnart	*Sminthopsis leucopus*				1		1
Common Brushtail Possum	*Trichosurus vulpecula*	14					14
Eastern Pygmy-possum	*Cercartetus nanus*	3	1				4
Sugar Glider	*Petaurus breviceps*	10					10
Common Ringtail Possum	*Pseudocheirus peregrinus*	12	3				15
Eastern Grey Kangaroo	*Macropus giganteus*	4	4	+	11	14	33
Swamp Wallaby	*Wallabia bicolor*	26	7	2	7	+	42
Koala	*Phascolarctos cinereus*	2					2
Common Wombat	*Vombatus ursinus*	1	+	+	+	+	1
Gould's Wattled Bat	*Chalinolobus gouldii*			2			2
Chocolate Wattled Bat	*Chalinolobus morio*	3		1			4
Little Forest Eptesicus	*Eptesicus vulturnus*	10	2				12
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	24	5				29
Water-rat	*Hydromys chrysogaster*			2			2
House Mouse	*Mus musculus*	9	1	6	8	3	27
Bush Rat	*Rattus fuscipes*	36	6				42
Swamp Rat	*Rattus lutreolus*	17		10	1		28
Black Rat	*Rattus rattus*	7		3			10
Fox	*Vulpes vulpes*	1	+	+	+	1	2
Cat	*Felis catus*	1					1
Brown Hare	*Lepus capensis*				1		1
European Rabbit	*Oryctolagus cuniculus*	2	+	+	+	+	2
Total number of species		20	12	12	10	6	24

[1]Habitat Types: 1 - Woodland; 2 — Closed-scrub; 3 — Wetland community; 4 — Heath; 5 — Coastal plant communities.

+ recorded by indirect evidence eg. scats, burrows and tracks.

supplementing the information in Norris *et al.* (1979) where the distribution of vertebrate species in South Gippsland has been mapped on to a five minute grid system. The grid boundaries are shown on Fig. 1.

Notes on the Species

Nomenclature and systematic order follow the Australian Mammal Society (1980). Details of each species are given below. MV numbers are the registration numbers of voucher specimens returned to the Museum of Victoria.

ORDER: MONOTREMATA
Family: Tachyglossidae

Short-beaked Echidna *Tachyglossus aculeatus* (Shaw)

Six Echidnas were sighted during the survey, five in woodland and one in closed-scrub. All animals were recorded in late spring or summer. Most observations occurred during the day, except one animal which was found to be active at midnight after a very hot day in January 1981. Augee *et al.* (1975) showed that when day temperatures rise above 40°C Echidna activity shifts into the evening, as observed on this occasion.

ORDER: MARSUPIALIA
Family: Dasyuridae

Brown Antechinus *Antechinus stuartii* Macleay

The Brown Antechinus was the most abundant mammal trapped (49 captures), and was recorded during every visit. This species was widespread and most commonly found in the woodland habitat. It was not recorded in the closed-scrub or coastal plant communities. Juveniles were first captured in January and no males were recorded during spring. This is consistent with the known life history strategy of this species, where there is a total male mortality after a brief breeding season in August (Lee *et al.*, 1982).
MV C16169.

White-footed Dunnart *Sminthopsis leucopus* (Gray) (Plate 5)

One animal was recorded in May 1982 in the northern section of the area. It was found in a nest under a fallen fence post in an area of regenerating heath. As this species is not commonly caught in conventional traps it is probably more abundant than this one record would suggest.

Family: Phalangeridae

Common Brushtail Possum *Trichosurus vulpecula* (Kerr)

The Brushtail Possum was the second most commonly recorded arboreal species, with thirteen sightings. It appeared to be confined to the woodland habitat.

Table 2. Trapping and spotlighting rates within the five habitat types.

SPECIES	HABITAT TYPES[1]					TOTAL SUCCESS RATE
	1	2	3	4	5	
TRAPPING						
Brown Antechinus	3.4	0	2.3	0.7	0	2.5
Common Brushtail Possum	0.1	0	0	0	0	0.1
House Mouse	0.7	0	7.0	5.6	1.1	1.3
Bush Rat	2.6	4.1	0	0	0	2.1
Swamp Rat	1.3	0	11.6	0	0	1.4
Black Rat	2.5	0	3.5	0	0	0.5
Trap-nights	1328	147	86	144	263	1968
SPOTLIGHTING						
Short-beaked Echidna	0.02	0	—	—	0	0.02
Common Brushtail Possum	0.26	0	—	—	0	0.25
Eastern Pygmy-possum	0.04	1.0	—	—	0	0.06
Sugar Glider	0.20	0	—	—	0	0.19
Common Ringtail Possum	0.30	0	—	—	0	0.29
Eastern Grey Kangaroo	0.06	0	—	—	1.0	0.08
Swamp Wallaby	0.36	1.0	—	—	0	0.37
Koala	0.02	0	—	—	0	0.02
Spotlight-hours	49.5	1	0	0	1	51.5
PIT TRAPPING						
Pit-nights	66	0	0	0	0	66
BAT TRAPPING						
Bat trap-nights	18	1	0	0	0	19
MIST NETTING						
Mist net-hours	28.5	2	0	0	0	30.5

[1]Habitat types as for Table 1.

Table 3. Species recorded in the five minute latitude by longitude grids encompassing Gellions Run, to supplement information provided in Norris *et al.*, (1979). Grid boundaries are shown in Fig. 1.

SPECIES	FIVE MINUTE GRIDS			
	A	B	C	D
Short-beaked Echidna	–	+	+	+
Brown Antechinus	+	+	+	+
White-footed Dunnart	+			
Common Brushtail Possum	+	+	+	+
Eastern Pygmy-possum	—	+	—	+
Sugar Glider	+	+	+	+
Common Ringtail Possum	—	+	+	+
Eastern Grey Kangaroo	+	+	+	+
Swamp Wallaby	+	+	+	+
Koala	—	—	+	+
Common Wombat	+	+	+	+
Gould's Wattled Bat	—	+		
Chocolate Wattled Bat	+			
Little Forest Eptesicus	+	+	—	+
Lesser Long-eared Bat	+	+	+	+
Water-rat	+			
House Mouse	+	+	+	+
Bush Rat	–	+	+	+
Swamp Rat	+	+	—	+
Black Rat	—	+	+	+
Fox	—	+		
Cat	—	+		
Brown Hare	+			
European Rabbit	+	+	+	+

A — 38°35'S 146°30'E; B — 38°35'S 146°35'E
C — 38°40'S 146°30'E; D — 38°40'S 146°35'E.
Latitude and longitude is given for the north-west corner of the grid.
+ species recorded in the grid during the survey
species not recorded in the grid during the survey.

Family: Burramyidae

Eastern Pygmy-possum *Cercartetus nanus* (Desmarest) (Plate 6)

One male was caught in a pit trap in October 1977 and two animals spotlit in woodland dominated by Manna Gum and Saw Banksia. Another individual was sighted in a closed-scrub Swamp Paperbark thicket adjacent to woodland. MV C24880.

Family: Petauridae

Sugar Glider *Petaurus breviceps* Waterhouse (Plate 7)

This species appeared to be confined to the woodland habitat where ten sightings were made, all in Manna Gums.

Common Ringtail Possum *Pseudocheirus peregrinus* (Boddaert)

The Ringtail was the most common arboreal species. Fifteen animals were recorded, twelve in woodland and three in closed-scrub.

Family: Macropodidae

Eastern Grey Kangaroo *Macropus giganteus* (Shaw)

The Eastern Grey Kangaroo was common and widespread. It was recorded from all habitat types, with the highest densities in areas of heath and woodland in the northern section. In May 1982 three animals were found shot dead.
MV C22708.

Swamp Wallaby *Wallabia bicolor* (Desmarest)

Plate 5. White-footed Dunnart *Sminthopsis leucopus*. Photo R. Forse.

This species was common and widespread in all habitat types with most sightings in woodland. Nine animals were found shot dead in May 1982.

Family: Phascolarctidae

Koala *Phascolarctos cinereus* (Goldfuss)

Single animals were recorded in woodland on two occasions, in October 1977 and May 1981. This species, although uncommon now, was once abundant in South Gippsland. At the turn of the century, where Manna Gums were common on the river flats " . . . practically every tree contained one or more koalas". (Lewis, 1954). Due to shooting, both commercially and for 'sport', clearing of the forests and bushfires, Koalas had virtually disappeared from Victoria by the 1920's, except for populations near Yarram and the islands of Westernport Bay (Lewis, 1954). In 1945 the then Fisheries and Game Department released 70 Koalas in the Hedley area and 69 on Snake Island, as part of a re-establishment program using animals from the islands of Westernport Bay (Norris *et al.*, 1979). The small population now at Gellions Run possibly originated from these introductions, or may be partially descendant from the surviving population near Yarram.

Plate 6. Eastern Pygmy-possum *Cercartetus nanus*. Photo P. Robertson.

Plate 7. Sugar Glider *Petaurus breviceps*.

Family: Vombatidae

Common Wombat *Vombatus ursinus* (Shaw)

This species was widely distributed and found in all habitat types. In the coastal plant community it was recorded only in the tussock grassland dominated by Spear-grass. Few animals were sighted but judging by the number of scats and burrows located, Wombats appear to be uncommon in the southern section and moderately common in the north.

ORDER: CHIROPTERA

Family: Vespertilionidae

Gould's Wattled Bat *Chalinolobus gouldii* (Gray) (Plate 8)

Plate 8. Gould's Wattled Bat *Chalinolobus gouldii*

Two individuals were caught in January 1982 using trip lines over a swamp surrounded by woodland.

Chocolate Wattled Bat *Chalinolobus morio* (Gray)

Three females were caught in the woodland habitat and one was caught using trip lines over a freshwater swamp.

Little Forest Eptesicus *Eptesicus vulturnus* Thomas

This bat was most commonly trapped in woodland, with several other individuals recorded in closed-scrub of Swamp Paperbark. Ten males and two females were caught.
MV C25249.

Lesser Long-eared Bat *Nyctophilus geoffroyi* Leach (Plate 9)

This was the most common bat species recorded. Twenty-nine individuals were captured — eleven males and eighteen females. The majority were caught in woodland, with others trapped in closed-scrub of Swamp Paperbark and on a woodland heath interface.
MV C25248.

ORDER: RODENTIA
Family: Muridae
Water-rat *Hydromys chrysogaster* Geoffroy

Two animals were observed in a freshwater swamp in the northern section on an overcast day in May 1982. The presence of other suitable habitat such as drains and paperbark swamps suggests this species may be more widespread than indicated.

House Mouse *Mus musculus* (Linnaeus)

The introduced House Mouse was widespread and common, and was the only rodent recorded in all habitat types. It was most abundant in heath and the drier sections of wetlands. It was also the only small mammal trapped in the coastal plant community, where it was found in tussock grassland dominated by Spear-grass.

Bush Rat *Rattus fuscipes* (Waterhouse)

The Bush Rat was the second most common species trapped, with a total of forty-three captures. It was recorded only in the closed-scrub and woodland habitats. In the latter it was absent from areas where the understorey was donimated by Austral Grass Trees. Adults were captured in an equal sex ratio and juveniles were recorded in late spring and summer.
MV C16982.

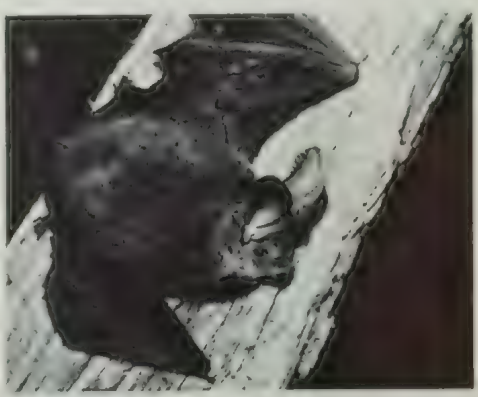

Plate 9. Lesser Long-eared Bat *Nyctophilus geoffroyi*.

Swamp Rat *Rattus lutreolus* (Gray)

The Swamp Rat was most common in the wetland habitat but was also recorded in heath and woodland. Most of the animals found in the woodland were either adjacent to swampland or in areas

with a heathy understorey. It was not recorded in woodland with an understorey dominated by bracken or grass trees.
MV C25794.

Black Rat *Rattus rattus* Linnaeus

The introduced Black Rat was the least common of the three rat species with a total of ten animals trapped. It was recorded only from the woodland and wetland habitats.

ORDER: CARNIVORA
Family: Canidae
Fox *Vulpes vulpes* Linnaeus

The Fox was widespread and common throughout the area, as indicated by scats and several sightings. One animal in poor condition was seen during the day, searching for food on a small beach amongst mangroves. Scats found in this and other areas within the coastal plant community contained predominantly crab remains.
MV C22707.

Family: Felidae
Cat *Felis catus* Linnaeus

The only record of this species was of one animal spotlighted in a Manna Gum in woodland approximately two kilometres from the nearest farmhouse. It appeared to be reasonably tame and was considered to be a free-ranging domestic cat, although feral cats are also likely to be present in the area.

ORDER: LAGOMORPHA
Family: Leporidae
Brown Hare *Lepus capensis* Linnaeus

A roadkill Brown Hare was found on the South Gippsland Highway along the northern boundary of Gellions Run, on the edge of heath.

European Rabbit *Oryctolagus cuniculus* (Linnaeus)

This species was common and widespread throughout all habitat types.

Discussion

Gellions Run supports a relatively diverse mammal fauna, with 18 of the 23 native species recorded from coastal South Gippsland (Norris *et al.*, 1979) present. Of the species not recorded, the Swamp Antechinus (*Antechinus minimus*) utilizes, in coastal regions, dense tussock grassland, sedgeland and closed heath (Wainer and Gibson, 1976). The area in Gellions Run which would appear most suitable for this species was the tussock grassland community along the western drain. This area was trapped unsuccessfully. Even if it were originally present, heavy grazing by stock would have probably now rendered this locality unsuitable. The Swamp Antechinus has been recorded on nearby Sunday Island (Menkhorst and Mansergh, 1977).

The New Holland Mouse (*Pseudomys novaehollandiae*) requires a mosaic of regenerating heath (Cockburn, 1978). It has been found further east along the coast and on Wilson Promontory (Norris *et al.*, 1979) but it is doubtful if Gellions Run has heath in sufficient stages of regeneration to support this species.

The Southern Brown Bandicoot (*Isoodon obesulus*) appeared to be absent from the area although sufficient suitable habitat is available. It is not particularly trap-shy, and none of its characteristic diggings were observed. Norris *et al.*, (1979) found it to be widespread and fairly common on the coast and plains west of Wilsons Promontory but did not record it from the coast east of the Promontory.

Other species not recorded at Gellions Run may occur sporadically. The nomadic Grey-headed Flying-fox (*Pteropus poliocephalus*) possibly visits on occasions, as it has been recorded from Port Welshpool, in 1951 (Menkhorst and Mansergh, 1977) and in May 1982 (pers. obs.). The Hog Deer (*Axis porcinus*) was not recorded during the survey by either direct observation or indirect evidence, but the LCC (1981b)

lists the hunting of Hog Deer as a recreational pursuit in Gellions Run. There is a population on nearby Snake Island and animals occasionally stray on to the mainland (I. Carroll, Fisheries and Wildlife Division, pers. comm.). However, they do not appear to have become established in Gellions Run.

During the study, all habitat types were not surveyed with equal intensity, hence it is likely that some of the species were more widespread than indicated. This bias was due to two factors, a larger survey effort undertaken in woodland due to the predominance of this habitat type, as well as the fact that some survey techniques cannot be successfully employed in all habitat types. For example, bat trapping in open areas such as heath and coastal plant communities is not normally very productive.

Species diversity was found to be greatest in woodland, with 83% of the total mammal species recorded. The only species found exclusively in woodland were the Common Brushtail Possum, Sugar Glider and Koala. The species not recorded in this habitat were the White-footed Dunnart, Gould's Wattled Bat, Water-rat and Brown Hare. The Wattled Bat, however, would most likely roost in the woodland.

Twelve species were found in closed-scrub, the Bush Rat being the only small terrestrial native mammal. The wetland habitat supported twelve species, with the Swamp Rat recorded in its highest densities, whilst the Bush Rat appeared to be absent. Ten species were recorded in heathland. The White-footed Dunnart, considered to be generally uncommon with a restricted distribution in South Gippsland (Norris *et al.*, 1979), was found only in this community.

The coastal habitat was found to support six species, only three of which were native. The Swamp Wallaby, Fox and European Rabbit were the most widespread species within this community, occurring in the glasswort and sedgeland zones. Three additional species, Eastern Grey Kangaroo, Common Wombat and House Mouse, were only recorded from the sedgeland community. The sedgeland and glasswort zones were subject to heavy grazing and trampling pressure from stock, thereby reducing their potential to support native ground-dwelling mammals.

During the survey, several techniques other than standard trapping and spotlighting were employed. One of these, pit trapping provided the only capture of the Eastern Pygmy-possum. This method has proved more successful than conventional cage trapping in desert areas (eg. Cockburn *et al.*, 1979), and is a useful supplement in forested areas to detect small trap-shy species. Searching under logs and other debris resulted in the only record of the trap-shy White-footed Dunnart.

Many of the common species in Gellions Run were found in lower densities than elsewhere in comparable areas. The Brown Antechinus and Bush Rat are normally abundant in areas of relatively undisturbed vegetation, within their range. For example a similar survey conducted on the Mornington Peninsula revealed an overall trapping success of 5.7% for the Brown Antechinus even though it was recorded from only four of the nine survey localities (Callanan and Gibson, 1977). At Gellions Run the trapping success for this species was 2.5%.

Similarly, the arboreal species appeared to be in low densities. The Common Ringtail Possum, although the most abundant species, was recorded in relatively low numbers, when compared to other coastal areas, such as the Mornington Peninsula (Callanan and Gibson, 1977).

An area of woodland habitat similar to that of Gellions Run occurs at Holey Plains State Park approximately 45 km to the north-north-east. This area has a

similar faunal composition with the common ground-dwelling species, and some arboreal species also in low numbers (Lobert and Gell, 1984). The only species recorded at Holey Plains but not at Gellions Run was the Red-necked Wallaby (*Macropus rufogriseus*).

The bat fauna of this region of Gippsland appears to be low in species diversity. Four species were recorded at Gellions Run, four at Holey Plains (Lobert and Gell, 1984) and five at Mullingdung State Forest (40 km to the north-east) (pers obs.). The three localities differed only in the Eptesicus species recorded with the Large Forest Eptesicus (*Eptesicus sagittula*) additionally recorded at Mullingdung. Considering all three areas the Little Forest Eptesicus and Lesser Long-eared Bat were the most common species trapped.

The Swamp Wallaby and Eastern Grey Kangaroo appeared to be subject to shooting pressure in Gellions Run. In May 1982 twelve animals were found shot dead, and a party of shooters were observed concentrating specifically on these species. In a small isolated area of native vegetation such as Gellions Run this type of pressure could seriously affect the viability of the populations.

Gellions Run is one of the few areas remaining on the Victorian mainland where there is a large area of saltmarsh and mangroves bordered by an extensive relatively undisturbed hinterland. Being the only extensive area of natural vegetation on the northern shore of Corner Inlet, it contains the last remnants of the local indigenous mammal fauna, and hence warrants protection. This will be partially achieved by the formation of the Nooramunga Marine and Wildlife Reserve, but the value of this reserve would be increased if the northern section could also be added.

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Further Studies on the Systematics of Australian Ctenizid Trapdoor Spiders: Description of a New Species of *Homogona* Rainbow from Victoria (Mygalomorphae: Ctenizidae).

By Barbara York Main*

Introduction

This paper is the ninth in a series dealing with the systematics of Australian Ctenizidae. Earlier papers in which new ctenizid species were described or genera reviewed were listed by Main (1983 and in press).

Main (1983) transferred *Homogona* Rainbow from the Migidae to Ctenizidae and elevated the tribe Homogonini to subfamily rank. Raven (1984) does not recognize the subfamily Homogoninae. Nevertheless, until affinities of *Homogona* with ctenizid genera outside Australia is elucidated and reorganization of the family is undertaken I retain the subfamily ranking of Homogoninae. Its members are distinguished from other Australian ctenizids by the absence of a rastellum.

Main (1983) recognized two species of *Homogona*, *H. pulleinei* Rainbow and *H. cunicularius* Main. Both species occur in rainforests: the former is confined to south eastern Queensland and north eastern New South Wales, the latter to northern Queensland. Main also indicated that *pulleinei* might comprise a complex of species. The occurrence of species of an undescribed genus of the Homogoninae in southern Australia was also mentioned by Main (1983, p. 81). These species, from the Stirling and Porongurup Ranges (Western Australia) and Victoria had previously been alluded to as migids (Main, 1976; p. 69). Main (in press) has subsequently described the new genus from Western Australia but there stated that the Victorian species belongs in *Homogona*. The new species is described here.

Homogona victoriae sp. n. (Figs. 1-7)

Holotype ♀ *Colour* generally brown, carapace glabrous; legs with dark markings, abdomen mauvish-brown with

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pale, narrow dorsal transverse divided bars. Carapace length 8.2 mm, width 6.3, caput width 4.7. *Carapace* with deep cervical and radial depressions; stout marginal bristles; a line of short bristles between eyes and fovea; short scattered bristles over carapace. Fovea almost straight, reflexed at edges, a deep notch-like depression behind fovea. *Eyes.* Length of eye group 0.9, anterior width 1.5, posterior width 1.4. Diameters of eyes ALE 0.4, AME 0.2, PLE 0.3, PME 0.15; ALE apart 0.9; ALE from PLE 0.4. Anterior row procurved. *Chlicerae.*

Apically rounded and with heavy dorsal bristles (Fig. 3). Teeth rows of groove indistinctly demarcated, promargin with large teeth (right 9, left 8), retromargin with small teeth (right 6, left 5) (Fig. 6). *Labium.* Length 1.3, width approximately 1.5, anteriorly truncate; with long bristles and two bluntly pointed cuspules (more in many specimens), *Maxillae.* Pronounced antero-ectal process; long rounded heel, about 40 cuspules spread from antero-ental angle to mid point. *Sternum.* Length 4.0, width 3.5; long scattered bristles; sigilla round, posterior well away from margin; narrow suture between labium and sternum. *Legs* and palps with numerous lobate sculptured bristles and hairs in addition to sparse "normal", acutely terminating bristles. Paired *tarsal claws* with one large tooth and sometimes a minute tooth underneath; median claw smooth. *Trichobothria.* Tarsi with 7 to 11 (of which proximal 2 to 4 are baton-like), metatarsi with 6 to 9, tibiae with 3 to 5 in each of two proximal rows.

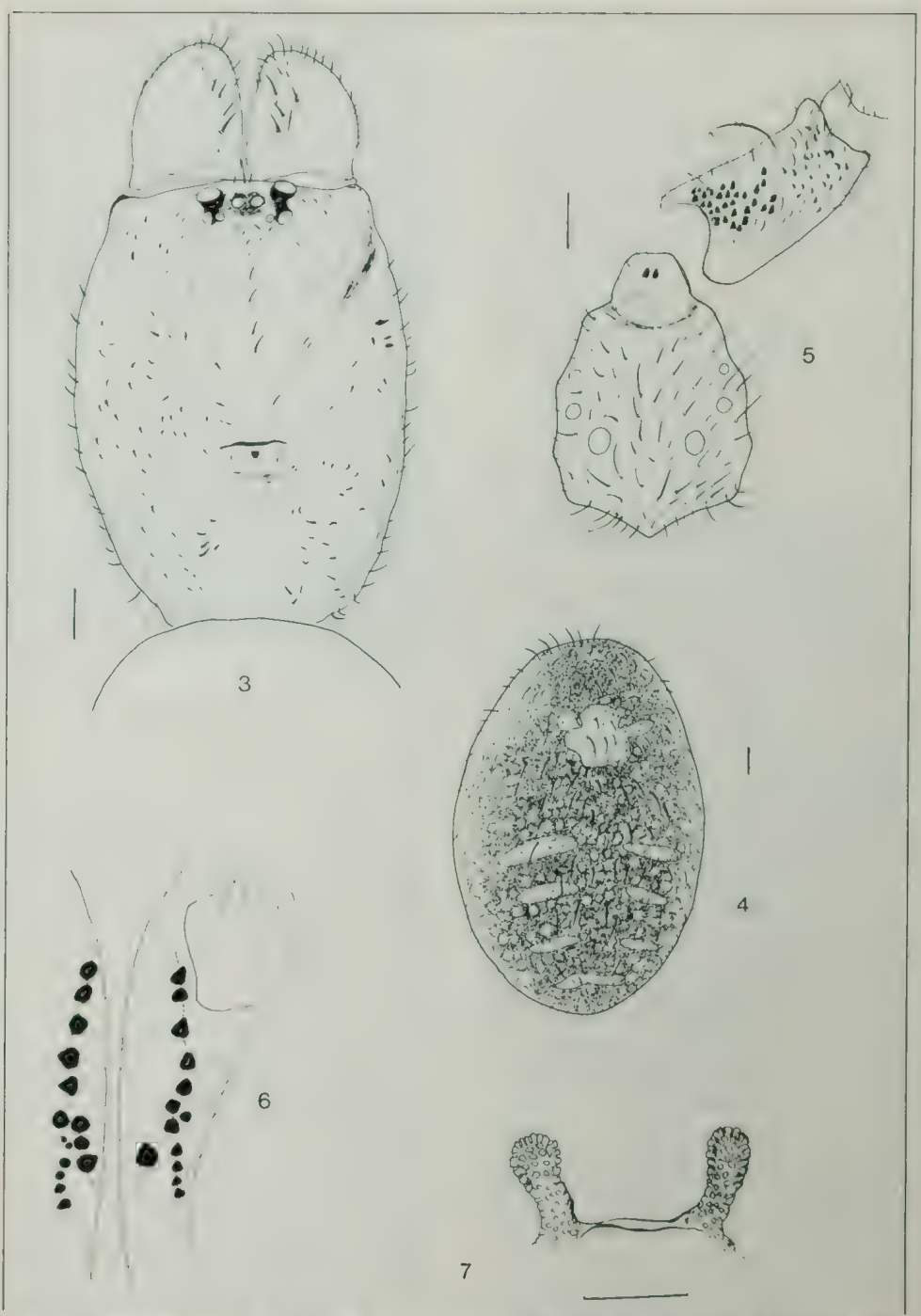
Spines. Heavy ventral spines in irregular biserial rows. Palp, tarsus pv 6, rv 7, tibia pv 9, rv 8, p 6, patella pv 2, rv 1, femur pv 2 apical +1. Leg I, tarsus pv 6, rv 4, metatarsus pv 10, rv 11, tibia pv 10, rv 8, patella 2 ventral apical. Leg II, tarsus pv 6, rv 4, metatarsus pv 6, rv 4, tibia pv 3, rv 4. Leg III, tarsus v 4, metatarsus v 7, pd 2, rd 1, tibia v bristles, pd 1, patella p 2. Leg IV, tarsus v 2, metatarsus v 6.

Figs. 1, 2. *Homogona victoriae* sp. n.; entrance of burrow of specimen from Barney's Creek, Grampian Mountains; 1, closed; 2, open. Scale = 1.0cm

Abdomen length about 13.5 mm, width 9.7. Heart with four paris ostia (BYM 1959/409). Two pairs spinnerets, median pair not reduced. Internal genitalia a pair of broad stemmed, terminally dilated vesicles, connected at the base by a narrow, transverse atrium (Fig. 7, paratype BYM 1959/412A).

Type material: HOLOTYPE ♀ : Victoria, Grampian Mountains, Barney's Creek, 14 Dec. 1959, B. Y. Main (BYM 1959/411, Museum of Victoria K-162).

PARATYPES. (All collected by B. Y. Main, various localities Grampians Mts.). Same data as holotype: ♀ internal genitalia dissected, (BYM 1959/412A, Museum of Victoria K-163); ♀ , (BYM 1959/408, Australian Museum KS 15534); ♀ , heart dissected, (BYM 1959/409); ♀ , (BYM 1959/410); 2 ♀♀ , 7 juveniles (BYM 1959/412); immature ♂ , kept



Figs. 3-7. *Homogona victoriae* sp. n. females, 3-6 (holotype); 3, carapace and chelicerae; 4, abdomen dorsal view; 5, sternum, labium and left maxilla; 6, cheliceral grooves with teeth; 7, internal genitalia, paratype (BYM 1959/412A, Museum of Victoria K-163).
Scale: 3-5 = 1.0 mm; 7 = 0.5 mm; 6, not to scale.

Table 1. Leg measurements of *Homogona victoriae* sp. n., female holotype.

Leg formula:	4	1	2	3		
	2.47	2.17	1.96	1.62		
	F	P	Ti	M	Ta	Total
Palp	4.7	2.6	3.0	—	3.3	13.6
I	6.1	3.5	3.9	3.3	2.0	18.8
II	5.2	2.8	3.3	2.9	1.9	16.1
III	4.1	2.3	2.5	2.6	1.8	13.3
IV	6.2	3.3	4.3	4.2	2.3	20.3

Width of patella I at knee, 1.4; Tibial index, 1.89
Width of patella IV at knee, 1.4; Tibial index, 1.71

alive in laboratory for two and a half years, moulted autumn 1960, died before maturation, (BYM 1959/413). ♀ with egg sac, Delly's Dell, 14 Dec. 1959, in tree fern trunk, (BYM 1959/416); ♀ , same data, specimen dead infested with (parasitic?) maggots, (BYM 1959/417); gravid ♀ , Barney's Creek, 8 Feb. 1965, (BYM 1965/6); ♀ , same data as preceding, (BYM 1965/7); ♀ , with egg cocoon, Silverband Falls Road (Delly's Dell), 8 Feb. 1965, (BYM 1965/9); ♀ with brood, Dairy Creek Road, 27 Nov. 1965, (BYM 1965/702).

Other material tentatively included in *H. victoriae*: All from Mt. Beauty Victoria, collected by B. Y. Main. Juvenille, 20 Nov. 1965, (BYM 1965/667); 3 ♀♀ (BYM 1965/668, 669, 670); ♀ , 2 juveniles (BYM 1965/672); penultimate ♂ , died in laboratory (BYM 1965/673).

Distribution: Known only from the Grampian Mountains and Mt. Beauty.

*Natural history:*The spiders build burrows in wet, shaded gullies, frequently in the mossy banks of creeks. The nests are shallow, silk-lined and closed by drawing over one side of a soil-impregnated silk collar which effectively simulates a hinged door (Figs. 1, 2). A female with egg cocoon was collected on 8 February 1965, and females with brood young in the burrow were collected on 14 December 1959 and 27 November 1965. Presumably males run in the early summer.

No adult males have been collected but females are distinguished from the other species by the irregular arrangement of the cheliceral teeth, fewer "clubbed hairs", fewer labial cuspules; and further, from *cunicularius* by the stouter internal genitalia and "door" of nest. Thus further postponement of a description seems unwarranted, particularly in view of the apparently disjunct distribution and hence zoogeographic interest of the genus.

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Newspapers as a Source of Information about Natural History

BY PETER BALMFORD*

Historians have for a long time made use of newspapers as a source of information, especially about a period or a topic or a place on which the other available information is insufficient. Similarly, ornithologists sometimes make use of observations or comments about birds published in a newspaper, particularly in the case of items published in the last century. There were then no ornithological journals in Australia and the first issue of *The Victorian Naturalist* — a general natural history journal — did not appear until January 1884. Consequently, a person who wished to share an observation with others, by writing about it for publication, was driven to do so in the public press.

As late as 1912, for example, the editors of *The Emu* (A. J. Campbell and Charles Barrett) added the following footnote to a short paper by H. Stuart Dove (1912):

> Recently a "Nature Note" published in *The Argus* stated that some observers, while fishing in the neighbourhood of Port Phillip Heads, noticed a flock of Flame-breasted Robins flying over the sea. There was no doubt the birds were heading inland. But where did they come from?

Workers on the Flame Robin Survey of the Victorian Ornithological Research Group will instantly see the relevance of this item to the question whether the Flame Robin *Petroica phoenicea* migrates across Bass Strait.

Unfortunately, Campbell and Barrett did not give a reference to the issue of the *Argus* (a Melbourne newspaper) in which the 'Nature Note' they mention actually appeared. Moreover, diligent search by Christopher Balmford and myself, covering the files of the *Argus* for the period April 1911 to September 1912, failed to find it; though perhaps we were wrong in thinking that nothing earlier than that could reasonably be regarded in 1912 as published 'recently'.

In 1912, a journalist named Donald Macdonald (1857-1932; *Argus* 24 November 1932, p. 6; Whittell 1954, p. 462) was conducting in the columns of the *Argus* what would now be called a regular 'feature' on natural history: 'Nature Notes and Queries', published on Fridays. This had first appeared on Friday, 25 November 1904 and its last appearance was on Friday, 25 November 1932, two days after his death. From time to time he included observations of his own; but mostly he included observations sent in by his readers, often adding his own comments, and answered their queries. In addition, from 23 February 1909 until 22 November 1932, he was publishing 'Notes for Boys' — many of them on natural history topics — in the *Argus* on Tuesdays. These, he explained on their first appearance, were published separately because there was not room for all the nature notes and queries on one day. Sometimes of course there may be a gap in the regularity, because Macdonald was on holiday or sick or for some other reason, and sometimes the appearance of his column was deferred for a day or two because the editor of the newspaper chose to give priority to other matter.

On Macdonald's death, both these columns were continued without a break, at first with no byline and then, from March 1933, by A. H. Chisholm (1890-1977; Whittell 1954, p. 132; McGill 1977). Beginning with Saturday 8 August 1936, 'Nature Notes and Queries' was moved from Fridays to Saturdays. Beginning

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with Thursday 25 January 1934, 'Notes for Boys' was moved from Tuesdays to Thursdays and there it appeared as part of a supplement called the *Junior Argus* — which was itself moved to Fridays from 9 April 1937.

On Chisholm's appointment as Editor of the *Argus* (see the issue of 30 June 1937, p. 10), P. Crosbie Morrison (1900-58; Whittell 1954, p. 538; Garnet 1958) took over both columns: Chisholm's last contributions being on 2 and 3 July; Morrison's first on 9 and 10 July. From 30 September 1937 the *Junior Argus*, with 'Notes for Boys', was published on Thursdays instead of Fridays and from 16 October 1937, 'Nature Notes and Queries' appeared in another supplement, the *Weekend Argus* issued on Saturdays.

When Morrison was appointed as Editor of the monthly *Wild Life*, Norman McCance (1891-1973; Jukes 1965, 118; *Weekly Times* 10 January 1973, p. 3) took over both columns: Morrison's last contributions being on 14 and 16 July 1938, McCance's first on 21 and 23 July. McCance's Saturday column incorporated his already existing column dealing with contract bridge: it was not headed 'Nature Notes and Queries' but at first 'Birds, Beasts — and Bridge', later 'Nature Notes and Bridge'. This column disappeared in 1939, following I think the issue of 1 July.

On Thursday 17 August 1939, it was stated in the *Junior Argus* that McCance was taking annual holiday leave and that his 'Notes for Boys and Girls' (as 'Notes for Boys' had by then come to be called) would be resumed on 7 September. In fact they do not seem to have ever appeared again. A few months later, however, David Fleay (1907-; Whitell 1954, p.241) began a regular feature in the body of the *Argus* headed 'Nature Notes'. The first of his columns that I have found was on Saturday 30 December 1939, the last on Saturday 27 December 1941, shortly after Pearl Harbour.

Many of the notes published in these series (Anon. 1940; Chisholm 1958) are of no importance and over the years there is a good deal of repetition. But clearly the notes had a considerable effect in encouraging interest in natural history and undoubtedly they include observations and comments of lasting value. It is not very difficult to search for an item that is known, or is thought likely, to have been published in Macdonald's columns or in those of his successors. Ordinarily, it is only necessary to look at two issues in each week; there is a high degree of consistency as to the part of the paper in which the column is published and that simplifies the job of locating the column in a particular issue. For the same reasons it is not too arduous, at any rate for a limited period, to search simply in the hope of finding something of interest.

However, there is no certainty that the 'Nature Note' that Campbell and Barrett (or one of them) had in mind was in fact published in Macdonald's columns — though 'Nature Notes and Queries' was indeed the title of what he published on Fridays. Nor can it be assumed that the note, whatever it was, had in fact been published 'recently' when they were writing: it is notorious that people often say that something happened much more recently than in fact it did happen.

So one may be obliged to scan many issues, sometimes with no result, through ignorance of the date, or the likely or approximate date, on which a known or supposed event was reported, or simply in the hope of finding useful material.

What is needed of course is a decent index. And sometimes an enterprising publisher provides us with an index: the *Argus* itself was furnished with an index (though not a very detailed one so far as natural history items are concerned) for a substantial part of its history.

That history lasted from the first issue on 2 June, 1846 until the final one on 19 January 1957. Between 1848 and 1878 the *Argus* was owned, wholly or partly, by Edward Wilson (1813-1878; Nairn 1976, p. 412) — usually referred to as 'Edward

Wilson of the *Argus*'. Critical of the Government in its early years, it became Tory in its attitude from 1859 until it was acquired by the London *Daily Mirror* interests in June 1949: see the issue of 27 June 1949. Its format and content then became more 'popular' but the change was not a success and publication ceased in 1957 because of continuing heavy losses: see the issue of 19 January 1957.

Long runs of bound copies of the *Argus* are held at the State Library of Victoria, at the Supreme Court Library in William St., Melbourne, at the Libraries of the University of Melbourne and Monash University and no doubt elsewhere. Some or all of those libraries also have copies of the *Index to "The Argus"*, published in half-yearly parts and covering the period from 1 January 1910 to 30 June 1949. J. A. Feely, Chief Librarian at the State Library of Victoria from 1960 until his death in 1965, compiled in his leisure hours an index to the *Argus* from its inception in 1846 to April 1859. His index, in typescript, may be consulted at the State Library.

Rosemary Balmford (1978) made use of this index when preparing her article 'Early Introductions of Birds to Victoria': see her paper 'Historical Ornithology' (Balmford, 1981; p. 8).

The first portion of Feely's index, covering the period 1846 to 1854, was published by the Library Council of Victoria in 1976 and is still in print. The preface to that volume indicates that the Council planned to publish the rest of his index in due course; but so far that has not been done and the typescript index at the State Library is all that is available.

Of course, if the event for which one is searching was of sufficient importance to have been reported in the *The Times* (London), the published index to that paper may well serve as a guide to other papers of the day, in England or in Victoria or anywhere else. *The Times* began publication on 1 January 1785 as *The Daily Universal Register* and adopted its present name from 1 January, 1788. It has continued, with occasional interruptions, until the present day. Bound volumes covering many years are held by the State Library of Victoria and by Monash University Library and perhaps elsewhere in Melbourne. An Index to *The Times* was published by Samuel Palmer, beginning in 1875 and working backwards for the period 1790 to 1867, and beginning in 1868 and working forwards for the period 1867 to 1930, all in quarterly parts. *The Times* has published its own index, under various names and with varying periodicity, from 1906 until the present time. These indexes are available at the State Library and at Monash University — at Monash, partly in hardback and partly on microfilm.

Even when the date of an occurrence is known, it must be remembered that it will probably not be reported at the earliest until the following day or, in the case of Saturday's events, until two days later. And in the years before Australia was in cable or wireless contact with Europe, there will naturally be no report in England of an Australian event for weeks or even months after it happened, and similarly with the Australian report of an event in England.

Care must be taken with a report when found: it is common experience that newspaper reports are often inaccurate in some details. But a later issue of the paper will sometimes contain material which corroborates, contradicts or even corrects a report that was published earlier; and sometimes of course confirmation can be obtained from some quite different source. In any case, even inaccurate facts, or opinions no longer generally held, may be of historical relevance and interest.

One of the history projects planned by the History and Heritage Committee to mark Victoria's 150th anniversary, and being implemented with the co-operation of the Departments of History at the Victorian universities, is to index the *Argus* from 1859 to 1909, a period not

covered by its own index or that compiled by Feely. Volunteers to assist in the work have been called for — and more would be welcome. Each volunteer is given a set of instructions and asked to index the six issues of one week by completing a short note on a card for each item. When the indexing for that week has been completed (the work takes about a day and a half), the organisers will allot another week to the volunteer who is willing to continue. Material on the cards is then assembled for sorting by computer and so the final production will be prepared.

I volunteered to assist in the project and was allotted the week from Monday 4th April, 1864 to Saturday 9th April, 1864. At that period, an issue comprised four pages of news and several other pages of advertisements. The advertisements are not being indexed.

When I came to do the work, I found a surprisingly large number of items relating to natural history. Some of these, as might be expected, are more interesting than others. But it seemed to me that it would be worthwhile writing some account of what I found, in order that more people would be aware of the kind of items relating to natural history that were being published in the press in those days. As will be seen, many of them relate to creatures not native to Australia: a large proportion of the readers of the *Argus* in 1864 had been born in Europe and was more interested in the exotic than in the indigenous. The attitude is exemplified by Anon. (1868, p. 74), in writing of imported birds in an aviary at Geelong as:

> pretty little feathered songsters, whose sweet warbling recalls to mind reminiscences of the dear old land sixteen thousand miles away.

Some of those who read this article will perhaps be encouraged to look at old issues of the *Argus* for themselves — and even, I hope, participate in the indexing project [contact John Hirst, History Department, La Trobe University, tel. 479 2430] and publish items of interest. We will certainly look forward to consulting the index when it is published — though there will be several years of work no doubt before that can happen.

Natural History in the Argus between 4 and 9 April 1864.

In the remainder of this article, references to the *Argus* during that week will be given in an abbreviated form: date, page, column. Thus, the reference '5th 4b' means: in the issue of 5th April 1864, on page 4, in the second column (counting from the left hand side by letters a, b, c, d, e, f, g for the standard seven columns per page).

First of all, the items about birds; of which there are four.

The first in point of time is a piece reprinted (5th 4b) from the *Sydney Morning Herald* of 31 March 1864:

> The schooner William arrived yesterday from a cruise among the South Sea Islands, and has made a successful voyage . . . She has on board a very large collection of birds, including three fine full-grown mooruks.

According to Thomson (1964, p. 482), 'mooruk' is a native name in New Guinea, sometimes used in English, for Bennett's Cassowary *Casuarius bennetti*. Whether the collection of birds on the *William* was for sale or for other purposes does not appear, nor does it appear whether it was a collection of live birds or a collection of skins.

The following item appears on the next page (5th 5d):

> An English thrush has been seen on the Dargo by M'Millan's exploring party.

M'Millan is of course Angus McMillan (1810-1865; Pike 1967, p. 183) whose name as an explorer appears on several memorial cairns in Gippsland and will, to that extent at any rate, be familiar to many readers.

The introduction to Australia of the English Thrush (no doubt the Song

Thrush *Turdus philomelos*) is discussed in Balmford (1978) and in Long (1981).

The issue which reported the sighting of the English Thrush on the Dargo also contains a report (5th 5e) from a 'member of M'Millan's exploring party in the Gipps Land Ranges' that Mr. M'Millan and Mr. Jones had arrived from the Dargo with

> the skull of some enormous bird, but slightly decayed, evidently not dead more than three years, and bearing a strong resemblance to the description generally given of the skull of Diornis, measuring sixteen inches long by seven or eight broad. Some of the party pronounced it to be the skull of an enormous pelican, but I am inclined to believe that it is the skull of the moa-moa.

The Moa, species of the extinct order Dinornithiformes, are not recorded from Victoria (or indeed anywhere outside New Zealand — 'supposed remains found in Australia are not now accepted as correctly attributed': Thomson 1964, p. 477). I do not pause to speculate on what this skull may in fact have been.

The remaining item specifically relating to birds is a report repeated (8th 7a) from the Daylesford *Mercury* of 7 April 1864, under the heading 'Pugnacity of the Native Robin'. This records an observation by a Mr. Soir, when 'taking a walk towards Sailor's Creek'. He saw 'a large number of robins' loudly twittering, two of them fighting

> and so desperately engaged that he was enabled to put his hand upon and capture the combatants

and so separate them.

During the VORG Pilot Atlas Project, 1 December 1975 to 31 December 1976, the only robins recorded in the Daylesford block were the Flame, the Scarlet and the Yellow, though the Rose, the Pink, the Red-capped and the Hooded were recorded in adjacent blocks: Aston and Balmford (1978), pp. 37-8. But, of all these robins, the only one in my experience likely to be found together in any number above two is the Flame and I am emboldened to say so by the comment of Pizzey (1980, p.239) that the Flame 'is the only red-breast regularly to form flocks'. Neither the Yellow nor the Hooded is likely in my opinion to have been called in 1864 'the Native Robin', at any rate not without further explanation. Consequently, I think it was probably Flame Robins that Mr. Soir handled.

The next three items are of general interest. The first may illustrate the problem arising in a newly settled country, as to whether a particular creature is sufficiently distinct from forms familiar in the homeland to be regarded as indigenous; or it may simply have been concerned with distribution.

It is a report (4th 5a), repeated from the *Ararat Advertiser*, of a good haul of 'shrimps (*sabinea*)' taken from the Hopkins River and of the view of several experienced gentlemen that shrimps are, for the most part, indigenous to all Victorian creeks and rivers.

A letter to the Editor (4th 7c), signed 'Frederick M'Coy', is an example of the difficulties, not unknown in the 1980s, of dealing with vernacular names. Sir Frederick McCoy (1817-1899; Pike 1974, p. 134), as he afterwards became, was Foundation Professor of Natural Science at the University of Melbourne and Director of the Museum of Natural and Applied Sciences.

McCoy is wanting to correct a report, published in the *Argus* of 30 March, of what he had said at a recent meeting of the Acclimatisation Society of Victoria:

> I stated that on Mr. Watts at one time asking me what fish our bream was, I said I found great difficulty in fixing the common or popular name of the ordinary fish and reptiles, as, probably owing to the population being new to the country, the popular observers were seldom sure of the identity of the creature they spoke of, and I commonly found several different fish and reptiles with one and the same popular name, in places

> a little distant apart; and I anticipated the publication of figures and descriptions of the different species of the animals of the country in the decades of the Melbourne Museum would tend to fix the names of various species, the habits, &c., of which could be observed advantageously by many observers in the country, and in this way a valuable natural history might subsequently be written.

The last item in this group (6th 5b) reminds us of the changed circumstances of many suburban areas of Melbourne:

> A snake of the carpet species, and measuring nearly three feet long, was killed yesterday afternoon, in a cottage adjoining the Sandridge Railway Station.

'Sandridge' is now called Port Melbourne.

The remaining items all relate to the international acclimatisation movement: a movement, in the words of Rosemary Balmford (1978, p. 238),

> concerned to disseminate animals and plants throughout the world, and to establish them in countries other than those in which they were naturally found, but where it was felt they had a useful part to play.

The leader of this movement in Victoria was Edward Wilson — proprietor, as already mentioned, of the *Argus* and President of the Acclimatisation Society of Victoria (Gillbank 1980). It is probably no coincidence that acclimatisation matters were mentioned frequently in the pages of the *Argus*; and the international nature of the movement can be seen from the items published.

The first, an item repeated (5th 5c) from the *Lyttelton Times:*

> Some frogs, the first imported into the province, arrived in the Lady Denison, and were sent by order of Major Hornbrook. They were shipped in the condition of tadpoles, but arrived at maturity during the voyage. They have been placed in some ponds at Mount Pleasant.

The next, a report (8th 5d) from Brisbane:

> The ship Wansfell, for London, takes a number of birds for the Acclimatisation Society, London.

Then a report (6th 5c) from Sydney, of two young watermoles from the Yass River brought before a meeting of the Acclimatisation Society of New South Wales; believed to be the first time they had ever been exhibited alive in Sydney. Doubtless these were Platypus *Ornithorhynchus anatinus*.

The issue of the *Argus* for the 6th (5e), in reporting the Annual Meeting of the Acclimatisation Society in Sydney, deals with a matter that can still arouse passions in the 1980s:

> The report shows that the society is prosperous. The society has decided to admit ladies as members.

The Acclimatisation Society had evidently been seeking financial assistance from municipalities in Victoria. An account of the proceedings at a meeting of the Sandridge [Port Melbourne] Borough Council (8th 6d) says that

> In a circular letter from the Council of the Acclimatisation Society, and in an elaborate memorandum which accompanied it, the operations of the society, and the advantages likely to be derived from their successful working, were set forth at length. The financial position of the society was also brought under notice, and the support of the council invited.

This letter was referred to the Finance Committee of the Borough Council.

Similarly, it appears from a report (7th 7c) of a meeting of the St. Kilda Borough Council that the circular letter from the Society had been received there. It was referred to a committee of the whole Council.

A topical event discussed at length on each day of the week 4th to 9th April 1864 was a Dog Show held on Thursday 7th and Friday 8th at the Exhibition Building, William Street, Melbourne

under the direction of the Council of the Acclimatisation Society and with the presence and patronage of the Governor.

—4th 4f

The Governor was Sir Charles Darling. Two days before the exhibition opened, the Secretary, Mr. G. Sprigg, was reported as 'at times fairly overwhelmed with the press of business' (5th 5d). A dimunitive of Sprigg's name — Spriggies — is said to have been used as a common name for the introduced House Sparrow *Passer domesticus* (McEvey 1975).

Edward Wilson's private importations of livestock were publicised also (9th 5d):

> By the Danish ship Jorgen Bruhn, Captain Kraft, which arrived in the Bay yesterday, after a smart passage from London, Mr. Edward Wilson has received a variety of additions to the stock of his experimental farm at Keilor. The list of the new arrivals embraces two Spanish she-asses, of high breed, and a foal dropped on the voyage; eight first-class sheep, of the Lincolnshire breed, and several lambs born at sea; eleven Alderney cows, and one young Alderney bull...

Then there are accounts of the importation of salmon ova from England for transmission to Tasmania and of the despatching of mainland fish to Tasmania.

> The steamship Victoria made a trip yesterday in the bay, with the members of the Acclimatisation Society on board, in order to test the vibration, with a view to ascertain whether the services of the Victoria could be made available in conveying the salmon ova (expected by the Norfolk) to Hobart Town.

— 6th 5c

The 'Victoria' was H. M. Colonial Steam Sloop *Victoria*, a wooden steamer of 580 tons which had been built to the order of the Victorian Government and brought out to Melbourne in 1856 for the purpose of harbour defence. See the references collected in Monie (1982) pp. 196-7.

The minutes of the Council of the Acclimatisation Society (xerox copy in the Monash University Library) throw further light on this transaction. The *Norfolk* had sailed on 23 January 1864 with 100,000 salmon ova on ice (Minutes, 15.3.64). The conclusion from the bay trip of 5 April was that the *Victoria* was suitable for the purpose of taking the ova to Tasmania, 'provided proper arrangements were made for their reception on board'. The Council resolved (Minutes 5.4.64) that 'the vessel be kept under sail as much as possible.' The *Norfolk* arrived on 15 April with the ova still alive; 11 boxes were kept in Victoria and 170 sent on to Tasmania by the *Victoria* (Minutes 19.4.64). The Minutes of 10.5.64 report that the ova were progressing favourably in Tasmania.

The Times of 8 June, 1864 (page 9c) carries a letter from James A. Youll in which he says that he has received a telegram from Edward Wilson reporting that the salmon ova had arrived safely in Melbourne and had been transmitted to Tasmania. This, he goes on, will be gratifying to those 'who responded to my appeal through your columns in January last' and helped in obtaining ova. In *The Times* of 14 July 1864 (page 5f), there is a description of the breeding ponds for the salmon ova.

The last two items to be mentioned, as having appeared in the *Argus* during the week 4-9th April, 1864, emanated from Tasmania.

Based on an account in the Hobart *Mercury*, there is a report (8th 5c) of

> the safe arrival in Hobart Town of the Murray cod and other Victorian fish sent over for acclimatisation purposes.

On the next day, the *Argus* repeats (9th 6g) from the Launceston *Examiner* a report that

> by the Tasmania several Murray River perch and other Victorian fish have been conveyed to Hobart Town

and the view that it was not desirable to introduce the Murray cod into Tasmania. It would feed on the salmon ova.

> Wait until the salmon is thoroughly established in our waters, and then those who are not satisfied with salmon may go in for Murray cod.

Conclusion

It seems appropriate to use again two sentences written by Chisholm (1958), in relation to the Nature columns of the *Argus* and the *Australasian*:

> Possibly, indeed, some diligent workers of the future will disinter much of the material. Their searching could well be soundly rewarded.

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Draft State Conservation Strategy

The Victorian Government has released a draft State Conservation Strategy for public comment.

Copies are available from the Manager, Environmental Policy, Ministry for Planning and Environment, 240 Victoria Parade, East Melbourne 3002. (Telephone 651 4669); over the counter at the Community Services Centre, 356 Collins Street, Melbourne.

Submissions will be received on the draft strategy until 31 March, 1985.

The Land Nemertine *Argonemertes australiensis* (Dendy) in South Eastern Australia

By L. Winsor*

Increasing urbanization, industrialization, agricultural expansion and conversion, deforestation and monoculture in south eastern Australia undoubtedly threaten the habitat and possibly the survival of many animal species, in particular the relatively poorly known cryptozoic fauna of the forests. This fauna "which is found living habitually under logs and stones and under the rotten bark of trees " (Dendy, 1889), is a well defined ecological grouping of taxonomically-unrelated animals (Savory, 1971) distinct from the soil fauna. It includes representatives of most of the arthropod orders, onychophorans, annelids, molluscs, land planarians and land nemertines.

Recently the International Union for Conservation of Nature (I.U.C.N.) declared three of the four species of Australian land nemertines as rare species — that is, taxa with small world populations that are not at present "endangered" or "vulnerable", but which are at risk. These taxa are usually localized within restricted geographical areas or habitats or are thinly scattered over a more extensive range (Wells, Pyle and Collins, 1983).

One of these nemertines is the predominantly south eastern Australian species *Argonemertes australiensis* (Dendy, 1889). This paper presents a synopsis of taxonomic, biological and distributional data on this species derived from the literature.

These data are augmented by additional information gained from the collection and examination of some 50 specimens of *Argo. australiensis* from 38 localities in Victoria and Tasmania.

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Materials and Methods

Specimens were collected together with other cryptozoa being currently investigated by the author. The nemertines were narcotized in 7.5% magnesium chloride or 7% ethanol and fixed in Tyler's fixative. Histological methods employed are described elsewhere (Winsor, 1984). Distribution of the species was plotted on a 10 minute data grid for all States (Brook, 1977). Sources of specimen records, together with appropriate registration numbers are indicated by the following abbreviations: Specimens lodged with museums as voucher specimens (V); sectioned for histological examination (H); from the Spencer Collection, Museum of Victoria (SC); derived from the author's collection (LWN); Museum of Victoria, Melbourne (MV) and the Tasmanian Museum and Art Gallery, Hobart (TMH). Latitude and longitude are provided for new localities.

***Argonemertes australiensis* (Dendy, 1889)**

Geonemertes australiensis Dendy, 1889, 1892, 1893, 1895; Fletcher 1891, 1895; Spencer, 1892, 1895; Haswell, 1914; Steel 1926; Flynn, 1928; Hickman, 1963; Pantin, 1961, 1969; Winsor, 1973, 1977; Moore, 1975.

Argonemertes australiensis (Dendy), Moore and Gibson, 1981; Wells, Pyle and Collins, 1983.

Type material

No type was designated by Dendy. Some specimens and incomplete series of microslides of *Argo. australiensis* from the Dendy Collection are now housed in the Pantin Collection, British Museum (Natural History) under the care of Dr Janet Moore at the Zoology Department, Cambridge, England.

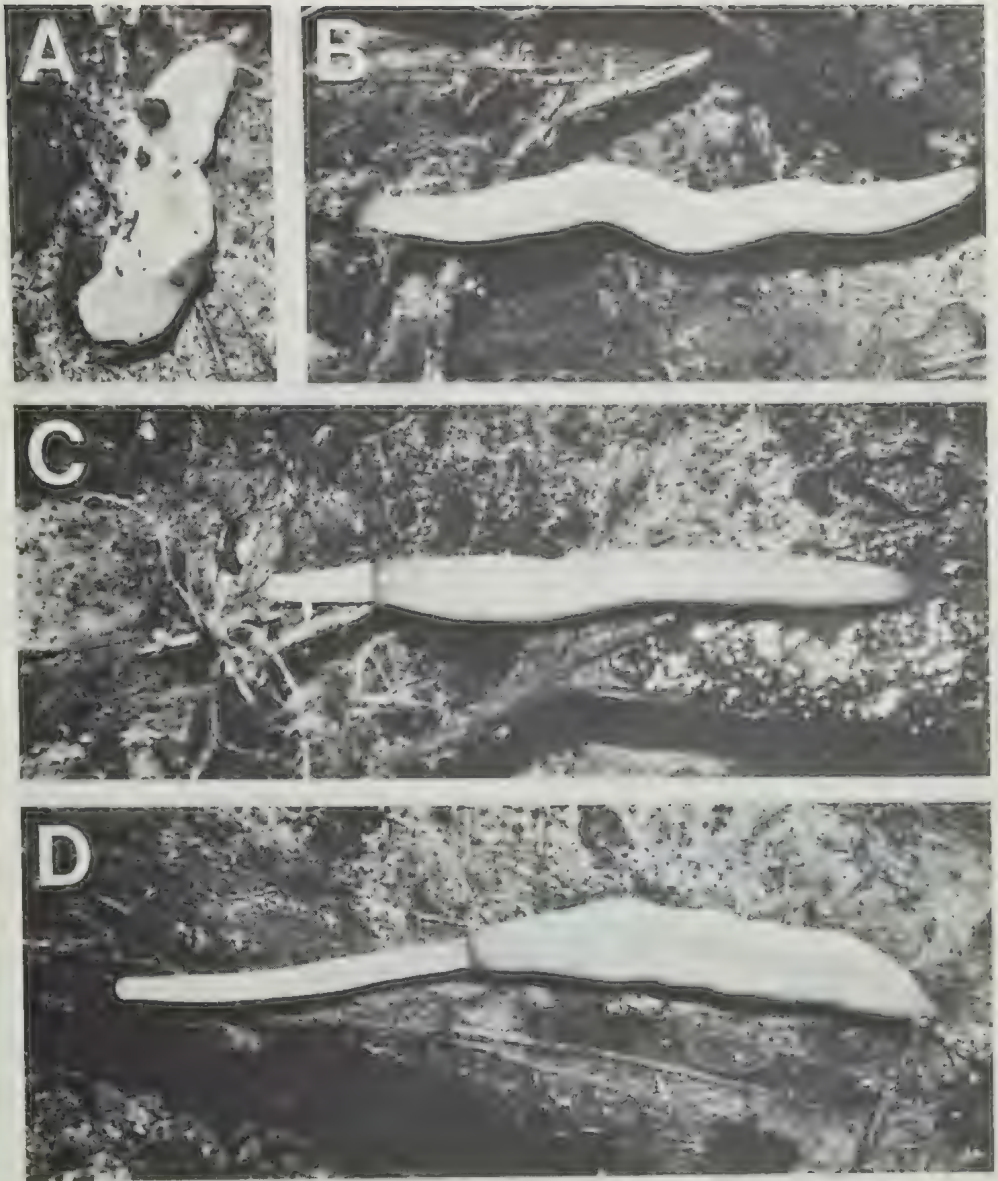

Fig. 1. *Argonemertes australiensis*. Specimen from Noojee, Victoria. A — at rest; B — crawling; C — partial eversion of proboscis; D — eversion of proboscis as an escape reaction.

Material examined

VICTORIA: MV (unreg.) Angahook Forest Park, 38°24′ 144°05′, B. Smith, ix. 1975; LWN 29, Barringo water catchment, 37°25′ 144°38′, L. Winsor, iv. 1972; LWN 08(S), Big River Camp, 37°29′ 146°05′, L. Winsor, vii. 1973; LWN 23, Bryce's Plain, 37°18′ 146°45′, L. Winsor, xii. 1972; LWN 12, Cockatoo, 37°57′ 145°29′, L. Winsor, i. 1981; LWN 15, Connor's Plain, 37°33′ 146°29′, L. Winsor, i. 1973; LWN 02, 03, Emu Plain, 36°56′ 148°20′, A. Brook, i. 1975; LWN 31, Gembrook, 37°57′ 145°33′, L. Winsor, ix. 1972; LWN 09(S), MV F5 1815 (V), Lake Tyres (Trident Arm), 37°52′ 148°05′, R. St. Clair, xii. 1976; LWN 18, Leongatha, 38°29′

145°57', E. Lyndon, v. 1979; MV G820 (SC), Loch, 38°22' 145°43', W. Spencer, vii. 1891, LWN 05, Lost Plain, 37°26' 146°46', M. Howes, iii. 1975; LWN 13, Monbulk, 37°53' 145°25', L. Winsor, xii. 1980; LWN 17, Moroka River, 37°31' 146°58', L. Winsor, i. 1973; LWN 06, 10, MV F5 1816 (V), Mt. Erica, 37°59' 146°23', A. Brook, i. 1973; LWN 21, 22, Mt. Howitt, 37°11' 146°39', L. Winsor, xii. 1972; LWN 11 (S), 27, 28, Mt. Skene, 37°26' 146°23', R. St. Clair, ii. 1975, F.S.G. iv. 1974; LWN 07, Noojee, 37°54' 146°00', H. Winsor, iv. 1973; LWN 38, Sherbrook Forest Park, 37°53' 145°22', L. Winsor, i. 1973; LWN 25, Stanley, 36°25' 146°46', L. Winsor, i. 1974; LWN 04, Starling's Gap, 37°52' 145°45', M. Campbell, vii. 1973; LWN 26, Tabberabbera, 37°33' 147°21', F.S.G., xii. 1973; LWN 01, Toolangi State Forest, 37°32' 145°29', L. Winsor, xii. 1977; MV G821 (SC), Warragul, 38°10' 145°56, W. Spencer, ix. 1892; LWN 14, 16 (S); MV F5 1817 (V), Wellington Plains, 37°32' 146°40', L. Winsor, i. 1973.

TASMANIA: MV G375, G699 (SC), Dee Bridge, 42°17' 146°37', W. Spencer, i. 1893; LWN 37; MV G2675 (S,V), Fingerpost, 41°26' 145°36', L. Winsor, x. 1975; LWN 34; MV G2673 (V), Fourteen Mile Creek, L. Winsor, x. 1975; LWN 32; MV G2671 (S, V), Hartz Mountains, 43°23' 146°46', L. Winsor, x. 1975; LWN 19; TMH K125, Lenah Valley, 42°56' 147°15', H. Winsor, xi. 1973; LWN 20, National Park, 42°41' 146°43', H. Winsor, xi. 1973; LWN 33; MV G2672 (S, V), Needles Picnic area, 42°46' 146°25', L. Winsor, x. 1975; MV G698 (SC), Parattah, 42°21' 147°24, W. Spencer, i. 1893; MV (unreg.), Pyengana, 41°17, 148°01, ii. 1970; TMH K125, Mole Creek, 41°34' 146°24', D. Turner, v. 1964; MV G822, Ridgeway, 42°56' 147°18, C. Oke, ix. 1949; LWN 36; MV G2674 (S, V), South Hatfield, 41°32' 145°39', L. Winsor, x. 1975; LWN 35; MV G2670 (V), Table Cape, 40°57' 145°44', L. Winsor, x. 1975; (TMH K429 (S), 430, 431, Savage River, 41°31' 145°13', R. E. Mesibov, 25.viii.1973, 16.ix.1973, 23.ix.1973. Not seen by author; determined by J. Moore, 1974).

Literature Records

QUEENSLAND: Lamington (Moore, 1975); NEW SOUTH WALES: Pretty Point, Mt. Kosciusko (Fletcher, 1895); AUSTRALIAN CAPITAL TERRITORY: Brindabella Ranges (Moore, 1975); VICTORIA: Angahook Forest Park, Anglesea (Winsor, 1977); Creswick (Dendy, 1892); Cumberland River, Lorne (Winsor, 1977); Dandenong Creek; Fern Tree Gully (Dendy, 1892); Healesville district (Mt. St. Leonards; Badger Creek) (Moore, 1975); Macedon Range (Winsor, 1977); Nar-Nar-Goon; Narrewarren; Myrniong; Otway Forest; Upper Yarra district (Dendy, 1892); Walhalla (Dendy, 1889); TASMANIA: Anson's Bay; Arve Forest; Cascades; Catamaran (Hickman, 1963); Dee Bridge (Spencer, 1895); Eaglehawk Neck; Exeter; Fern Tree; Glen Dhu; Great Lake; Hastings; Lenah Valley; Levandale; Liffy Falls; Mt. Barrow; Mt. Dromedary; Mt. Hobbs (Hickman, 1963); Mt. Wellington (Flynn, 1928); National Park; Organ Pipes (Hickman, 1963); Parattah (Spencer, 1895); Quamby Bluff (Hickman, 1963); St. Clair (Spencer, 1895; Hickman, 1963); Surprise Valley; Tarraleh; Trevallyn; Western Creek; Wilmot (Hickman, 1963); "Tasmania" (Haswell, 1914; Steel, 1926).

Specific Internal Characters

Cephalic glands well developed, posteriorly extending over brain; long anterior caecal diverticula; cephalic vascular system a network.

For positive identification of this species, specimens must be examined histologically.

Description

Argonemertes australiensis, at rest with proboscis retracted, (Fig. 1A, B), appears similar to a small slug or land planarian and is soft and slimy. The species is dioecious with males 10-60 mm long and 1.5-2.5 mm wide, slightly smaller than females, 12-84 mm in length and slightly wider particularly when gravid. The anterior extremity is rounded or slightly swollen into a 'head' with a single aperture, the rhynchodaeum, at the tip. Posteriorly the body gently tapers to a blunt end at the anus.

The eyes are arranged in the typical *Argonemertes* pattern of four groups at

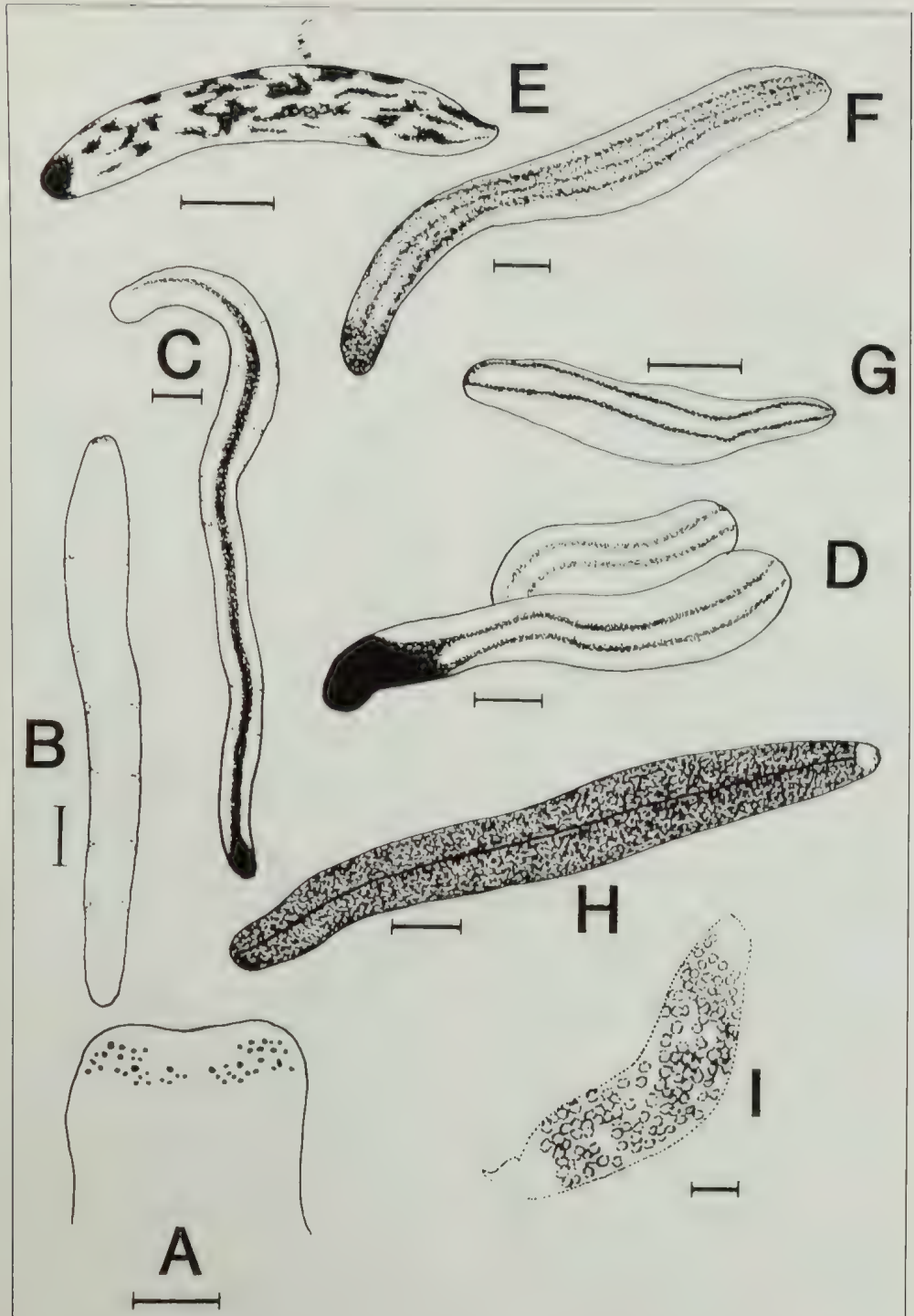

Fig. 2. *Argonemertes australiensis.* A — Eye pattern, cleared specimen from Jamieson, Victoria; B-G illustrate variation in markings, discussed in text. Scale bars for A represents 0.5 mm, those for B-H inclusive represent 2 mm length.

the anterior end (Fig. 2A). Newly hatched specimens have four eyes corresponding in situation to these four groups. As a nemertine develops in size more eyes appear in proximity to the primary four. Hickman (1963) found eye number in adult specimens to vary from 39-176.

This nemertean exhibits considerable variation in colouration and markings, particularly at the extremities of its range in Queensland and in Tasmania. The more commonly encountered combinations of colour and markings are:

(a) pale cream to dark reddish brown with anterior end usually darker and ventral surface lighter than the rest of the body. Sides of the body may appear mottled due to large ova showing through the body wall. Specimens of translucent waxy yellow, orange or light brown colouration commonly found in Victoria, N.S.W. and A.C.T. (Fig. 2B). Specimens with lighter and darker colours than previously mentioned mainly found in Tasmania and Queensland.

(b) with broad median dorsal stripe, light to dark reddish brown extending almost to margins; cream to orange coloured margins which extend ventrally (Fig. 1), mainly found in Victoria, N.S.W. and A.C.T.

(c) with single (Fig. 2C) or double (Fig. 2D) median dorsal stripe(s) extending posteriorly from the dark colouration of the anterior end. May be continuous or interrupted over the length of the specimen, found mainly in Tasmania and Queensland.

(d) light to dark brown colour dipsersed in irregular blotches over entire body on a ground colour varying from cream to light brown (Fig. 2E), mainly found in Victorian and Tasmania.

(e) similar to (d) but where the irregular blotches may be arranged in longitudinal rows forming an incipient stripe pattern, which in some specimens may be developed to well defined stripes, usually a single median and two lateral stripes (Fig. 2F), found in Victoria, A.C.T. and Tasmania. Some specimens may only show paired median dorsal stripes (Fig. 2G) in Tasmania, or lateral stripes only, in Victoria.

Both striped and non-striped examples have been found together in the same habitat. In Victoria, specimens with markings of types (b) and (e) sometimes show irregular brown mottling ventrally. Hickman (1963) reports that it is not unusual for egg capsules to contain young with brown blotches and young without any pigmentation.

In Victoria and Tasmania, pale coloured forms are generally found only in wet closed forest or temperate rainforest areas; brown coloured forms are found in closed forest and rainforest, but more frequently in more open environments particularly the alpine plains. Of the new material from Victoria examined in this study, 30% of the specimens were a fairly uniform waxy yellow in colour (Type (a) markings), 30% had Type (b) markings and 15% with markings of Type (e). The remaining specimens were mottled forms (Type (d) markings) and had been collected together with plain forms from areas mostly 1,100 metres or more above sea level.

The majority of Tasmanian specimens examined showed markings and colouration within the range for the species in Tasmania reported by Hickman (1963). However, specimens from Fingerpost and South Hatfield in western Tasmania were unusual, being dark brown dorsally with a thin median dark dorsal stripe and a cream coloured 'head' (Fig. 2H). No specimens were found that corresponded to those found by Spencer in Tasmania (Fletcher, 1895), reported to be longitudinally striped red. Indeed there appears to be no specimens or other confirmation of this colouration and marking for *Argo. australiensis*. There is however a Tasmanian land planarian, *Coenoplana* sp., white to cream in colour with a red median dorsal stripe and otherwise very similar to this nemertine, to

which Spencer's specimens might be referred.

Argonemertes australiensis can normally be readily distinguished from another south eastern Australian species, *Argo. hillii* (Hett) on the basis of colour (Moore, 1975). The latter species is usually a dark purplish brown or scarlet colour dorsally, with two deep red or orange-red lateral stripes, but colouration may vary to a plain orange; one such specimen from Point Lookout, N.S.W. (LW 39) was externally indistinguishable from *Argo. australiensis*, the true identity of the specimen being determined histologically.

Anatomy of *Argo. australiensis* is considered by Dendy (1892), Pantin (1963, 1969), Hickman (1963) and Moore (1975). Keys and comparative taxonomic data are provided by Moore (1975) and Moore and Gibson (1981).

Reproduction

Dendy (1893) and Hickman (1963) give accounts of the reproduction, egg laying and incubation. Copulation and egg laying occur throughout the year in temperate rainforest areas of Tasmania, and chiefly in the autumn and winter months in Victoria. Egg capsules are deposited in cool, moist cryptic microhabitats. During the egg laying the female remains stationary, and apart from the head the body is encased in a smooth elastic coat of tough mucus. Whitish eggs, some 0.6 mm diameter, are expelled through the sides of the body aided by muscular contractions. On completion of egg laying the nemertine crawls out of the mucus envelope which contracts and seals leaving the eggs suspended in a gelatinous matrix. Egg capsules (Fig. 2I) are generally spindle or sausage-shaped measuring 8-48 mm long, 4-10 mm diameter and may contain up to several hundred eggs each. Female nemertines may lay several egg capsules over a period of weeks. Development of the young takes 39-43 days. Embryology of *Argo australiensis* has been described by Hickman (1963).

Locomotion

Argo australiensis normally crawls with an even gliding motion, similar to that of a land planarian, achieved by combined action of cilia and muscles. As it crawls, the anterior end ('head') of the nemertine moves from side to side with a gentle nodding motion sensing the substrate. This behaviour is distinctive and differs from the more tactile or vibratory sensory motions observed in land planarians. Like the latter, however, nemertines leave behind them a slime trail.

If *Argonemertes* is irritated the proboscis, normally completely enclosed within the body, is suddenly shot out with lightning rapidity as vividly described by Dendy (1892). The everted proboscis is white, sticky, of greater length than the worm and armed with a stylet. Apart from its use for purposes of offense or defence, the proboscis is used as a means of locomotion.

When everted the proboscis (Fig. 1C, D) may attach to the substrate and when withdrawn the nemertine is suddenly pulled over it. In this way the worm may rapidly evade any threat by this escape reaction.

Food and Feeding

Little is known of the food and feeding habits of *Argo. australiensis*. Hickman (1963) observed the capture of a small collembolid, and it is presumed that the nemertean feeds upon small arthropods common in the same microhabitat.

Parasites

Argonemertes is parasitized by sporozoans and nematodes. Histological examination of specimens from the Needles Picnic area (MV G2672) and South Hatfield (MV G2674) in Tasmania, revealed heavy parasitization of the blood vessels by a gregarine-like sporozoan. Nematode larvae were found in the body wall and epidermis of a specimen from Lake Tyres, Victoria (LWN 09). There was no evidence of tissue reaction.

Larval nematodes, and less commonly gregarines, parasitize land planarians, found in the same microhabitat as nemertines. The specific sources of parasitic infection, and the identity of the parasites have not yet been established.

Habitat

The microhabitat in which nemertines are found has been described by Moore (1975) as "... rotting wood (damp but not wet enough for extensive fungal growth) or ... the underside of large stones, typically about 0.5 metres across, under which there is good soil or leaf litter and plenty of associated fauna". Such habitats protect the worms from desiccation, flooding, frost and heat. Most of the new material examined had been collected from the underside of rotting logs and beneath moss. Many habitats which support land planarians are unsuitable for nemertines, and the latter are often very local in occurrence (Moore, 1975).

Argonemertes has been recorded from a wide variety of habitats in Tasmania (Hickman, 1963) and in Victoria (Winsor, 1977). These range from situations almost at sea level, above the splash zone, through dry open forest and temperate rainforest to alpine plains 1,500 metres above sea level.

Under dry conditions nemertines retire deep within crevices in logs or stones, or into the decomposing centre of rotting logs. There is no evidence of *Argo. australiensis* encapsulating itself in a tough mucus cocoon as reported for *Argo. dendyi* (Pantin, 1950).

Occurrence

The distribution of *Argo. australiensis* in south eastern Australia is shown in Fig. 3. The most northerly occurrence of the species is Lamington, Queensland (Moore, 1975), the southernmost record is from Catamaran, Tasmania (Hickman, 1963) and most westerly record in the Otway ranges, Victoria (Winsor, 1977). The new records listed in this paper chiefly extend the known range of *Argo. australiensis* to northern and north Gippsland areas in Victoria, and to northern and western Tasmania. Records to the north-west and east of Melbourne consolidate earlier records from these areas.

In south eastern Australia *Argo. australiensis* is largely confined to the Cool temperate and Cold temperate thermal zones of the Bassian zoogeographic sub-region (Winsor, 1977), indicated by distribution of the species in Victoria (Fig. 4) and Tasmania.

There are a number of regions in which *Argo. australiensis* would be expected to occur, but for which there are as yet no records. These areas include the Grampians, east Gippsland and north eastern region in Victoria; the south western coast, central east coast and possibly some of the Bass Strait islands, Tasmania, and in New South Wales the central and southern districts particularly

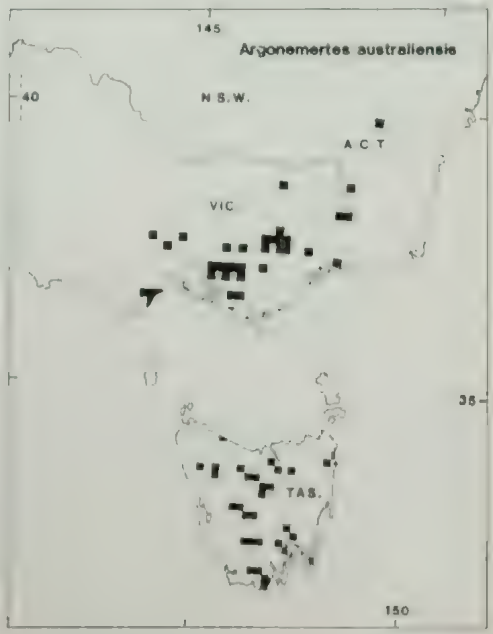

Fig. 3. Distribution of *Argonemertes australiensis* in south eastern Australia. The records from Lamington, south east Queensland are not shown on this map.

Fig. 4. Correlation of the distribution of *Argonemertes australiensis* in Victoria with Cool and Cold temperate Bassian zoogeographic regions. The map of the zoogeographic regions is after Rawlinson (1971).

along the eastern side of the Dividing Range. Although limited field trips have been undertaken in many of these areas further work is necessary to fully establish the distribution of this species.

Conservation

Primary threats to the survival of *Argo. australiensis* have been identified as obliteration of habitats by urban expansion and possible vulnerability to deforestation (Wells, Pyle and Collins, 1983). To these may be added the destruction of microhabitat by severe wildfire and possible adverse effects of frequent fuel reduction burning in some areas.

Of those localities from which *Argo. australiensis* was recorded by Dendy (1892, 1893) four — Dandenong Creek, Fern Tree Gully, Nar-Nar-Goon and Narrewarren — have now largely become incorporated into the outer suburbs of Melbourne. However remnants of these habitats have been conserved in the adjacent areas of Churchill and Fern Tree Gully National Parks, in the Forestry Reserves at Doongalla, Olinda and Sherbrook, and in the catchment areas of Cardinia Creek and Lysterfield reservoirs.

In addition, the species is conserved in the following National Parks and reserves from which it has been recorded: New South Wales: Kosciusko National Park; Queensland: Lamington National Park; Tasmania: Cradle Mountain-Lake St. Clair National Park; Eaglehawk Neck Scenic Reserve, Hartz Mountains National Park, Mt. Barrow Scenic Reserve and St. Columba's Falls Scenic Reserve; Victoria: Angahook Forest Park, Badger Creek Reserve, Barringo water catchment, Gembrook and Monbulk Forest Parks.

These scattered parks and reserves provide *Argo. australiensis* with some

measure of protection against destruction of habitat through various commercial developments. However in some areas in which the species is expected to be present but as yet not found habitat is being altered, for example by woodchip operations in Tasmania and in East Gippsland, Victoria. Nothing is known of the immediate and long term effects of present commercial deforestation practices, bushfires or fuel reduction burning upon land nemertine populations.

Acknowledgements

Dr Janet Moore is thanked for her identifications and comments on material collected by the author in Tasmania, and for information concerning possible Type material. Dr Brian Smith, Museum of Victoria and Ms Alison Green, Tasmanian Museum, kindly made specimens and records available for examination. Members of the F.N.C.V. Field Survey Group and my wife Heather provided considerable help in collecting specimens which is greatly appreciated.

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Field Naturalists Clubs List — Corrections

Colac Field Naturalists Club
P.O. Box 351, Colac 3250.

Western Victorian Field Naturalists Clubs Association
Hon. Secretary: Mrs. Win McPhee, P.O. Box 256, Stawell, 3380.

Northerly Range Extension of the Tiger Snake (*Notechis scutatus*) in Queensland

BY G. PORTER* AND G. GORDON**

Introduction

The range of *Notechis scutatus* in Queensland is shown as a strip entering Queensland from New South Wales in the area between the McPherson Ranges and the Granite Belt on the border and extending northward to about the Bunya Mountains (Cogger, 1979). The Queensland Museum has records from the Lamington National Park area, Ranges east of Warwick, Bunya Mountains, Toolara State Forest, near Buderim and Caloundra, and on North Stradbroke Island (Fig. 1).

This paper reports the collection of a specimen in Central Queensland, from Consuelo Tableland (Black Alley Range) within the boundary of Carnarvon National Park (NP 236; 148°10'E, 24°56'S) (Fig. 2).

Observations

On 2 October 1980, personnel from the Research and Planning Branch and Police Fauna Protection Squad of the Queensland National Parks and Wildlife Service visited a natural spring on Consuelo Tableland. In mid afternoon, a banded snake was disturbed, possibly while feeding, in one of the large rock pools formed by the spring.

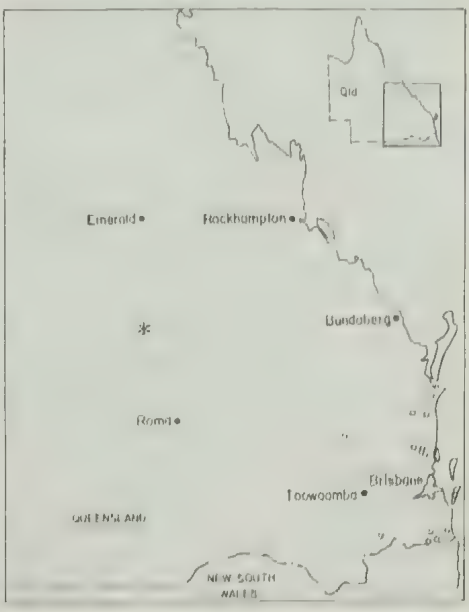
The reptile was not overly agressive and was captured. On closer examination the snake was found to be a Tiger Snake. The specimen was 99.5 cm in length, with very prominent dark bands across the back for its whole length. Scale counts were:

19 mid-body;
168 ventral;
52 sub-caudal;
anal divided (probably due to injury).

Several other healed wounds were obvious on the snake. At the time of capture, frogs were calling incessantly from the spring. On lodgement of the snake at the Queensland Museum (QM J 38269), the remains of several different species of frog (possibly *Litoria nasuta, Litoria inermis* and *Litoria latopalmata*) and the worms *Ophiascaris pyrrhi* and *Physaloptera confusa*? were taken from the stomach.

Further searching on 2 October 1980 failed to locate any other snakes. However, whilst on another trip to the same spring in November 1982, a sloughed skin of *N. scutatus* was collected and also lodged at the Museum (QM J 41022). Previous to the collection of the snake and skin, several sightings of Tiger Snakes had been made by Queensland National Parks

Fig. 1 Localities where *N. scutatus* has previously been recorded in Queensland (circles) and new locality from central Queensland (asterisk)



* Queensland National Parks and Wildlife Service, P.O. Box 1362, Rockhampton, Qld. 4700.
** Queensland National Parks and Wildlife Service, P.O. Box 42, Kenmore, Qld. 4069.

and Wildlife Service personnel working in the area.

Consuelo Tableland has several open forest types. Three of these are:

tall open forest of *Eucalyptus laevopinea*, var. *'consueloensis'*;

an open forest of *Eucalyptus crebra* and *Eucalyptus orgadophila* on the ridges and slopes;

and an open forest of *Eucalyptus tereticornis*, *Eucalyptus saligna* and *Angophora floribunda*.

These forests usually have sparse shrub layer, sometimes dominated by *Macrozamia* sp. or *Acacia implexa*, and a ground layer dominated by the grass *Themeda australis*.

In the area of the spring, the forest more closely resembles the latter type, with scattered ironbarks on the slopes. This habitat type is land unit 104 (Gunn and Nix, 1977) of the Black Alley Land System (Storey *et al*, 1967).

The Spring from its beginning on the edge of the tableland, flows over basalt rock forming cascades and rock pools for only a few hundred metres. Then it appears to be absorbed by the rocks, and no surface water is visible. This was the case at the time of collecting the *N. scutatus*, but after good rains the spring would be a flowing creek as it drains the water off the tableland.

The altitude is approximately 1100m above sea level. No information is available on annual rainfall or temperatures. The nearby town of Springsure has a mean annual rainfall of 678mm, a mean annual temperature of 28.9°C, and a mean annual minimum temperature of 13.8°C. However, the tableland areas have a much milder and wetter climate as indicated by the performance of the timber. The tall open forests reach heights of 45 metres, while a species such as *E. saligna* is characteristic of warm temperate forests of New South Wales.

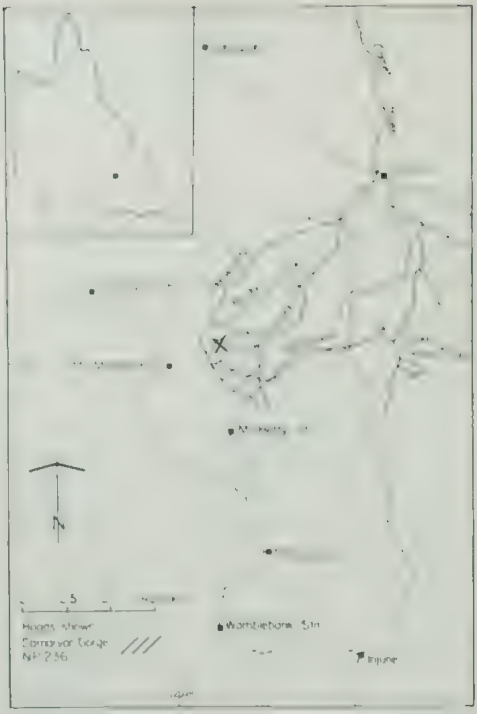


Fig. 2. Collecting locality of *N. scutatus* in Carnarvon National Park (X).

Discussion

The collection of *N. scutatus* on Consuelo Tableland extends the range some 430 kilometres from the nearest previous record, and indicates the snake is more widespread than previously thought. Its Queensland distribution is now shown to include at least one outlying population in central Queensland which is probably restricted to high altitudes.

It is interesting to note that warm temperate tall open forests have a relict distribution pattern in central Queenland on montane 'islands'. Two other such localities occur at similar latitudes, Blackdown Tableland (149°06'E, 23°44'S) and Kroombit Tops (151°00'E, 24°22'S) (Gunn and Nix, 1977). These plant associations were probably distributed more widely in central and southern Queensland during cooler and wetter climates, subsequently becoming

extinct there when the climate changed, except for relict communities on the warm temperate 'islands'.

As *N. scutatus* is now known to occur on Consuelo Tableland, it is likely that its distribution has been determined by similar factors. Other montane localities in central Queensland may also provide suitable habitat for this species.

Acknowledgements

Thanks are due to Const. G. R. Wardrope (who located the snake) and Sgt. J. G. Scott for their field assistance, Mr. W. J. Fisher (Senior Botanist, Queensland National Parks and Wildlife Service) for his assistance with the vegetation description, Miss J. Covacevich and G. V. Czechura (Queensland Museum) for their advice and encouragement, and Mrs. P. A. Gilmour and Miss R. A. Kreis for typing the manuscript.

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Naturalist Review

Native Plants of the Macedon Range

BY A. DAVIS & B. KEMP

Published by the authors, Macedon, 1984. $10.50 ($9.50 plus postage to members).

Books on aspects of natural history with 'Field Guide' on their title pages are becoming increasingly plentiful, and vary greatly in size, scope, and format.

Native Plants of the Macedon Range is a slim, soft-covered volume of 80 pages, measuring 220 mm x 170 mm (i.e. not a pocket guide). As its title indicates, it is based on a small geographical area, but most of the 122 plant species described occur widely in Victoria, so that the book will prove useful elsewhere, especially as quite a few of the species illustrated are not shown in other similar-style but larger books such as *Flowers and Plants of Victoria* (Cochrane, *et al.*).

The initial impression is one of attractive presentation. A hundred species (including eight ferns) are illustrated with good quality colour plates by the authors, and a further 22 with line drawings by Robert Watson, who has also provided the five habitat drawings which head each section. Each species illustration is accompanied by a paragraph of interesting and generally informative text, giving "notes about plant characteristics, habitat, related species, and some general information". A glossary of botanical terms is included.

If the book is being used for recognition and naming of shrubs and smaller plants when in flower, it will prove successful for most of the species included. Nomenclature is generally accurate and up-to-date, and it is noteworthy that *Dillwynia ramosissima*, previously overlooked in Victorian standard literature, has been included. The few inaccuracies and departures from convention are minor in nature, and will probably not bother anyone but botanists (e.g. *Pimelea* and its family Thymelaeaceae are incorrectly spelt throughout, and there are about a dozen typographical errors, mainly in the plant list and indexes; *Pterostylis alpina* is now *P. scabrida*, and the *Davisia* species on p. 64 is that still known as *D. virgata*).

The authors are to be congratulated for their initiative and work in putting together a book which *will* help local residents and visitors to recognise their native plants, especially with regrowth

after the February 1983 fires. The pity is that it could, I believe, have been still more useful as a field guide if closer attention had been given to selection and organisation of material. The first deficiency one discovers is the lack of any sort of map or definition of the area being treated; none of my working maps defines the 'Macedon Range' as such, yet the authors have included their plant list of 300 species for this 'area' which must extend almost to Woodend, judging by the listing of *Eucalyptus aggregata*. A map would also have helped us to understand the distribution of the five 'vegetation zones', and to locate the places referred to in the text. Finally, the arrangement of species within each of the sections appears to be completely random, and in some cases the selection of plants shows little relationship to the significant species referred to in the section introduction, or even to the 'zone' (notably the questionable 'sub-alpine habitat'). Some grouping in either structural levels or botanical affinities would facilitate the use of the book and aid understanding of relationships. Given the 'zone' introductions, one wonders also why dominant trees are given no simple diagnostic description.

Nevertheless, allowing for such limitations, I can certainly recommend this little book for its stated purposes.

— L. F. Costermans

FIELD NATURALISTS CLUB OF VICTORIA

Reports of recent activities.

General Meeting
Monday, 10th December

The North-East Field Naturalists Club was elected as an affiliated member.

The meeting stood and observed silence on the recent passing of two Club members, Eulalie Bennet and Des Wentworth. Alf Fairhall pointed out that Mrs Bennet had the record length of membership of any living member, having joined the Club at 18 years of age and attaining Honorary Life Membership in 1958. As well as being a very active member of this Club in the earlier part of her life she was also a very active member of the Beaumaris Tree Preservation Society. Mrs Bennet was one of the first members of the Day Group. Dan McInnes spoke about Des Wentworth who was a member of the Microscopy Group, having come over from the Microscopical Society of Victoria. His main interest in this field was Rotifers.

Honorary membership was awarded to Ken J. Simpfendorfer, on completion of 40 years membership.

Speaker for the evening was Paul Peake who in between postgraduate studies on *Antechinus swainsonii* at Monash University has been assisting research on the Baw Baw Frog. Australian Owls, the subject of Paul's talk reflects a keen interest — he wrote the Owl and Nightjar text for Simpson and Days' "Birds of Australia."

There are eight resident and one vagrant species of owl in Australia (110-120 species world-wide), all of which are poorly studied. Most closely related to Nightjars, Owls usually eat warm-blooded prey, have strong beaks, strong feet and strong stomachs (need to handle bones and fur which are regurgitated as pellets). There is also a size difference between sexes in which the female is larger than the male — a trait shared with diurnal raptores.

Australian Owls can be grouped into two categories, the Barn Owl group, and the Hawk Owls. The Barn Owl group, of which there are four species in Australia, has a worldwide distribution that is centred on Australia and South-East

Asia. They have a clearly-defined facial mask and tend not to hold territories, moving around with fluctuations in their prey. The Barn Owl (heart-shaped facial mask, legs virtually featherless) is one of the commonest owls in Australia — there have been claims of 30 in the one tree! The largest of the Barn Owl group is the Masked Owl, the most closely related to the Barn Owl. Occurring in both pale and dark phases this species has a round facial mask and feathered legs. The Grass Owl, from coastal north Australia and, occasionally, inland, has a triangular facial mask and usually feeds on rodents. The Sooty Owl breaks the trend of the Barn Owl group in that it vigorously defends territories. A regular breeder, it inhabits rainforest and wet sclerophyll forest and feeds on possums, gliders and rodents. Paul played tapes of the birds distinctive screaming and trilling calls.

Hawk Owls defend territories, roost in the branches of trees (i.e. not in hollows) and do not have facial masks. The Barking Owl occurs across tropical Australia, down the east coast, and also in the south-west of W.A. In southern Australia it is quite rare, yet in the north it is the commonest owl species. Paul has observed Barking Owls in forest near Chiltern for several years and has recorded one pair breeding together every year for the last four years. Such regular breeding is unusual. The audience was treated to recordings of the dog-like 'woof-woof' call.

The Powerful Owl, the second largest owl in the world inhabits heavily forested areas from the Victoria/South Australia border to just north of Brisbane. These birds hold territories of around 800 hectares and feed on Ringtail Possums, Greater Gliders and the like. They have been known to take young Koalas off their mother's back. The Rufous Owl is a large owl of northern Australia with a call similar to the Powerful Owl. Finally, there is the smallest of the Hawk Owl group, the Boobook Owl. Tapes were heard of their familiar 'Mopoke' call which in fact varies geographically. This is a common species that may be found in suburbia, yet the habits of which are little known. One clutch is reared per year and family groups roost together in the same tree.

Exhibits: There were a number of exhibits, as follows:-

—foliage of Norfolk Island Pine covered in white insects (larvae of a ladybird which feeds on mealybugs)

—owl pellets

—a collection of approximately 70 species of beetle from the Big Desert

—a colony of sea squirts

—*Psoralea pinnata*, which has become a weed in the Strezlecki Ranges

—Royal Bluebell, from the Alps

—a sample of hickory tree from Caulfield Park, whose leaves are fed on by possums.

—under the microscope three different colonies of Hydroids from Black Rock, viz. *Plumularia setaceoides*, *Circularia divergens*, and *Amphisbetia minima*.

A number of slides were shown from FNCV outings to Anglesea and Red Bluff. From the Anglesea trip were many slides of spiders and some orchids. The excursion to Red Bluff was notable for the large number of reptiles recorded, and slides were shown of Shingle-back, Western Blue-tongue, Bardick (rare Elapid snake), and Common Scaly foot. Mammals seen included the Silky Desert Mouse and Western Pygmy Possum. There was also a picture of a Yellow-rumped Pardalote coming to its burrow at the Red Bluff campsite.

Nature Notes: From Caulfield Park it was reported that an oak tree that had been burnt 10-12 years ago continued to grow leaves along its branches.

A Willie Wagtail was observed attacking Ravens and elsewhere a Raven was seen stripping bark, laying it in rows and then flying off with the bundle.

Finally, a Green Tree Frog was observed to attack and eat a cicada.

The Freshwater and Estuarine Fishes of Wilsons Promontory

BY P. D. JACKSON AND J. N. DAVIES. 1983

$2.00 plus 70 cents postage from Ground Floor Information Centre, Department of Conservation, Forests and Lands, 240-250 Victoria Parade, East Melbourne.

The arrival of a new fish guide on the market is always welcomed, for no matter how many may already exist each arrival seems to make some contribution, if nothing more than the updating of names or addition of new distributional information. With regard to books covering freshwater and estuarine fishes of Australia, and Victoria in particular, the currently available choice is not great, despite the recent publication of several treating the subject. "The Freshwater and Estaurine Fishes of Wilsons Promontory" published by the Fisheries and Wildlife Division of Victoria is a somewhat specialised addition to this area. The most readily apparent appeal of this glossy, 68 page booklet is the extremely high quality black and white figures illustrating the species treated, as well as certain aspects of their form and biology. In addition, interesting and often useful information about Wilsons Promontory and the fishes that occur within the area is presented.

Fishes of Wilsons Promontory is broken into seven chapters, including an introduction, a brief treatment of the evolution, structure and scientific nomenclature in fishes, a physical description of Wilsons Promontory, a discussion of interesting biological aspects of the fishes occurring in the area, full page accounts of thirty-four species reported from the Prom. and an explantation of pertinent fishing regulations, plus a references section, acknowledgements, an index and a glossary. Although most of these are easily justified, any attempt to cover the evolution, basic structure and scientific nomenclature of fishes in just over two pages is ambitious in the extreme. In addition, there seems to be little reason for the inclusion of a description of anatomical features in fishes, especially when they are mostly ignored elsewhere in the study.

Writing is noticeably inconsistent between chapters with "Habitat" describing the physical and floral features of the Prom. being well composed and easy to read, while "The Fishes", touching on aspects of their ecological adaptation, reproduction and feeding strategies contains sentences that are awkward at best or gramatically incorrect. Still others are difficult to understand without reading further. Some of the information presented in this section is in fact, contestable. On page 18 in a discussion of the locomotory habits of the smooth toadfish, it is stated that "forward motion is obtained by oscillations of the tail ... ". Actually, the tail is rarely used for movement in this species, the dorsal, anal and pectoral fins carrying out this function. The next sentence states "To escape predators they are able to inflate their bodies with air and then float belly upward at the surface ... ". On the contrary, tetraodontids inflate themselves with air only when removed from the water by non-aquatic predators such as man, certainly an extremely limited predator on these fishes. Moreover, why a fish floating upside down at the surface of the water is not vulnerable to attack is difficult to comprehend.

Species treatments are brief, but relatively uniform. It is not clear, however, whether the figure presented for the maximum length refers to total length, fork length, standard length or some other means of measuring. The inconsistency in use of phrases and sentences in commenting on the biology of the various species is somewhat disconcerting, as is the lack of order in presentation of families Common names for families are quite arbitrary. For instance, the Percichthyidae, presented as the Australian Freshwater Basses and Cods, includes not only totally marine species, but representatives from most other major continents as well. As mentioned above, the ink renderings illustrating each species treated are the high points of this work. The quality of these drawings is indeed excellent, although a few perhaps suffer from the limited familiarity of the authors with structural subtleties. This is exemplified by the absence of lateral lines in the figures of the pygmy perch, luderick, salmon and tailor.

Despite these rather critical comments "Fishes of Wilsons Promontory" does succeed in meeting its apparent aims and justifies a position in the libraries of those interested in Victorian natural history.

— **M. Gomon**

(Continued from inside front cover)

Park Beach Walk. Port Melbourne train leaves Flinders Street at 11.13 a.m. to North Port station, from there a walk along Nott Street and Stokes Street to lunch spot at beach. Then walk along beach to collect shells. Return by South Melbourne tram. Leader: Mr D.E. McInnes 211 2427.

Thursday, 18th April. Central Park and Hedgley Dene Park, East Malvern. Meet at 11.30 a.m. at terminus of No. 5 tram (Malvern Bourke Road) the corner of Wattletree Road, and Bourke Road Leader: Audrey Pittard 836 7725.

At the National Herbarium, Birdwood Avenue, South Yarra at 8.00 p.m.

Botany Group — Second Thursday.

Thursday, 14th March. "Study Courses in Field Centres of the UK." Mary Doery.

Thursday, 11th April. To be announced

Geology Group — First Wednesday.

Wednesday, 6th March. "Human Evolutionary Development."

Wednesday, 3rd April. To be announced

Mammal Survey Group — First Tuesday.

Tuesday, 5th March. The Mammals of East Gippsland and their occurrence in sites of Zoological Significance. Ian Mansergh

Tuesday, 2nd April. To be announced.

Microscopy Group — Third Wednesday.

Wednesday, 20th March. Some Old Microscopes. Mr. John Daws.

Wednesday, 17th April. Still Photography with the Microscope. Dr. E. Peters.

INSTRUCTIONS TO AUTHORS

The Victorian Naturalist invites contributions of original papers relating to Australian natural history, particularly of Victoria. All papers are assessed by an independent referee before publication.

Short contributions of natural history observations are also invited for use as "Naturalist Notes". These contributions may be edited, or excerpts published, at the Editors' discretion. Such notes are not normally refereed, and may be submitted more informally.

All contributions are to be written in concise, simple English.

For cost reasons, authors of original papers submitted for publication are requested to conform with the following guidelines. Any author who has difficulty in complying with these guidelines, or has queries concerning manuscripts, should consult the Editors before submitting a manuscript.

Submission of Manuscripts

Manuscripts should be sent to J. U. Phillips, C/O Museum of Victoria (Division of Natural History and Anthropology), 285 Russell Street, Melbourne, 3000.

Two typewritten copies of the manuscript should be submitted. Authors are advised to retain a further copy.

Format

Text should be fully revised, typed double spaced on one side of the paper only, with a wide margin, pages numbered consecutively, and should conform in style to recent issues of the *Victorian Nat.*

Author's name and address or institution should appear beneath the title. Underline only those words to be italicised in the text i.e. genus and species names, and titles of periodicals and books. All measurements should be expressed in the metric system (SI units).

References should be cited in the text as Brown (1981) or (Brown, 1981). Footnotes must be avoided. Acknowledgements should be grouped at the end of the paper before References.

References should be listed alphabetically by author's surname at the end of the paper. All references should be cited in the text. Abbreviations of titles of periodicals should conform with those in *A World List of Scientific Periodicals* (4th ed., Butterworth). Refer to recent issues of the *Victorian Nat.* for the formatting of references.

Tables and Figures

Tables should only be used for essential data needed to show important points in the text. They should be numbered consecutively, referred to in order in the text, and designed to fit within the print area of 115 x 180 mm. Each table must have an explanatory caption.

Figures may be in the form of drawings or photographs. They should be identified on the back with the author's name and the figure number. The top should be indicated and the magnification by scale where appropriate. Compass directions must be indicated where necessary. All figures should be referred to in the text and numbered consecutively (Fig. 1, Fig. 2 etc.).

Figures should be carefully prepared and should be submitted ready for publication. Each should have a short caption. Maximum size is 115 x 180 mm; single column width is 55 mm. Figures are preferably submitted at actual size. Lettering on Figures should be done by the author; care is needed to ensure that all letters are legible after reduction.

Line drawings should be made in black ink.

Photographs should only be used where essential due to the high cost of printing plates. They should preferably be unmounted, glossy black & white prints, showing good detail and moderate contrast.

Proof and Reprints

Galley proofs will be sent to the author, who should correct and return them as soon as possible. Only the minimum of essential corrections should be made

The reprint service is currently under review. Please direct enquiries to Russell Thomson, Department of Microbiology, La Trobe University, Bundoora, 3083.

Taxonomic Papers

Papers describing new taxa will not be accepted for publication unless the primary type material is deposited in a recognised public museum or herbarium.

It is suggested that in other more general papers where taxonomy is discussed, voucher material be lodged in a public collection, and the repository details cited in the text.

Field Naturalists Club of Victoria

In which is incorporated the Microscopical Society of Victoria

Established 1880

Registered Office: FNCV, c - National Herbarium, Birdwood Avenue, South Yarra, 3141.

OBJECTS: To stimulate interest in natural history and to preserve and protect Australian fauna and flora.
Members include beginners as well as experienced naturalists.

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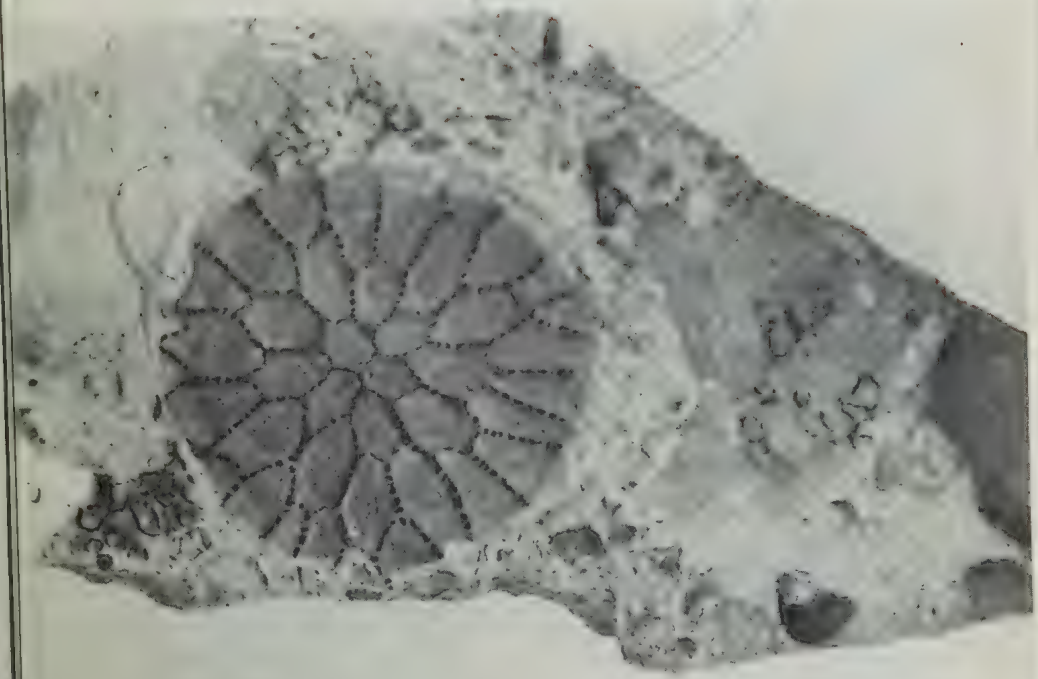

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GENERAL MEETINGS

Monday 15th April, 8.00 p.m.
Stephen Forbes. "Plants of the Kimberleys."
Honorary membership to be awarded to Mrs. Eric Muir.

Monday 13th May, 8.00p.m.
Annual General Meeting. Dr Brian Smith. "Krakatoa."

Monday 17th June, 8.00p.m.
Peter Jackson. "Native Freshwater Fishes of Victoria."

New Members — January/February General Meetings.

Metropolitan
Mr. Gary Lewis, 2 Monbulk Court, Cheltenham, 3192.
Mrs. S. Murley, 27 Mill St., Aspendale, 3195.
Mr. Don Teese, 9 Lamont Ave., The Patch, 3792.
Mr. Ross Williamson, 2 Bayview Ave., East Hawthorn, 3123.
Mr. David Andrew, 5/37 Davis Ave., South Yarra, 3141.
Mr. Greg Sessions, 5/37 Davis Ave., South Yarra, 3141.

Joint
Mrs. I. Dunn, 18 Brooker St., Cheltenham, 3192.

Country
Barbara York Main, Dept. of Zoology, Univ. of W.A.

Joint Country
Mrs. A. F. Hagger, "Willunga", Maroondah Parade, Healesville, 3777

Affiliated Club
North-East Field Naturalists Club, Wangaratta.

Retired
Miss Margaret Barrett, 12/11 Maverston St., Burwood, 3125.

Student (Full Time)
Tony Roscioli, 27 Finningley Drive, Tullamarine, 3043.
Brian Glassenbury, 44 Fawkner St., Essendon, 3040.

FNCV EXCURSIONS

Sunday 5th May. Blackwood. Leader: Mr. Graham Love. This is an interesting historic mining area with a wide range of natural history as well. The coach will leave from Batman Ave. at 9.30 a.m. Fare $10.00. Bring a picnic lunch.

Sunday 2nd June. Sherbrooke. The coach will leave from Batman Ave. at 9.30 a.m. Fare $9.00. Bring a picnic lunch.

Preliminary Notices: 9th - 21st August. Rainbow Beach, Fraser Island and Noosa Heads. Several members have expressed an interest in an excursion to this region but prefer August to September as first suggested. More details later. It is proposed to run this excursion from Brisbane to Brisbane.

Saturday 31st August - Friday 6th September. Rotamah Island Bird Observatory. A tentative booking has been made for this period. Accommodation is in an old farmhouse and it will be necessary to take a towel, sleeping bag and pillow-slip. Mattresses and pillows are supplied with full board. Cost $27.00 per day. Further details from Excursion Secretary. Numbers are limited so book early.

GROUP MEETINGS

FNCV members and visitors are invited to attend any Group Meetings.

Day Group — Third Thursday
Thursday, 16th May. Maranoa Gardens. Leader: Mr. A Fairhall. 578 2009.
Thursday, 20th June. The Arthur Rylah Institute, Heidelberg. Leader: Joan Miller 836 2681.

At the National Herbarium, Birdwood Ave., South Yarra at 8.00 pm.

Botany Group — Second Thursday.
Thursday, 11th April. "Fungi". Mr. Bruce Fuhrer.
Thursday, 9th may. "An Excursion to N.S.W."
Thursday, 13th June. Members night.

Geology Group — First Wednesday.
Wednesday, 3rd April. "Fossils in Victoria". Mrs G. Love.
Wednesday, 1st April. To be announced.
Wednesday, 5th June. To be announced.

Mammal Survey Group — First Tuesday
Tuesday, 2nd April. To be announced.
Tuesday, 7th May. "Notes on North Queensland Mammals". William Ashburner.
Tuesday, 4th June. To be announced.

Microscopy Group. — Third Wednesday.
Wednesday, 17th April. "Still Photography with the Microscope". Dr. E. Peters.
Wednesday, 15th May. "Foraminifera" Mr. H. Bishop.
Wednesday, 19th June "How to make a rock section". Mr. D. McInnes.

(continued on page 70)

The Victorian Naturalist

Volume 102, Number 2

March/ April, 1985
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Cover Illustration: A Devonian Tabulate Coral from Heathcote. See article on page 57.

Distribution of *Callitris* in Victoria and Some Relic Populations Close to Melbourne

By Robyn Adams*

Conifers have been well represented in the Australian flora since at least the Cretaceous, some 65 million years ago. *Callitris* is one of the eleven genera of present day conifers in Australia and has fossils dating from the Tertiary (Otfler, 1969). This genus consists of about fourteen species, most of which have been exploited at some time for their timber, resins, oil or tannins. Although *Callitris* is not a large genus, it is a major component of several plant communities across the continent.

Five species grow in Victoria, in communities from areas of low or irregular rainfall, and generally on dry rocky slopes or soils of low fertility. Examples in Victoria are the *C. rhomboidea* — *Eucalyptus* woodlands of the Grampians, the *C. preissii* — *Casuarina* woodlands of the Mallee and the *C. columellaris* woodlands of East Gippsland. A good key to the Victorian species and an outline of previous synonomy can be found in Willis (1962), and Costermans (1981) provides a clear set of line drawings and photographs to aid identification.

Callitris verrucosa (A. Cunn. ex Endl.) F. Muell. (Scrub Pine; Turpentine Pine) is confined to the infertile sandy soils of the Mallee (Fig. 1a). It is a small multi-stemmed scrubby tree, rarely exceeding 7m in height, but easily identifiable because of the clusters of globular, warty cones it bears. Cone diameters range between 17-30 mm, and the columella is often three-lobed but of variable height. The foliage varies in colour from bright green to bluish green, depending on the amount of wax coating the branchlets.

* Botany Department, La Trobe University, Bundoora, Vic. Present Address: Faculty of Applied Science, Victoria College Rusden Campus, Clayton, Vic

Callitris preisssii Miq. (Slender Cypress-Pine) is found on a wider range of moderately fertile soils in the Mallee and Wimmera districts (Fig. 1b). It is generally a tall, single stemmed tree growing up to 18m and, unlike *C. verrucosa*, occurs only with dark green foliage. The slightly ovoid cones are borne in large clusters and cone diameters range between 20-45 mm. The dorsal surface of the cone-scales are coarsely wrinkled and bear scattered warts. The height and shape of the columella are both quite variable. The cone-scales are thick and do not separate to the base as the cone opens.

C. columellaris F. Muell. (Murray Pine; White Cypress-Pine) can usually be distinguished from *C. preissii*, as the cones are solitary, borne on slender pedicels, and generally do not persist on the tree from year to year. The cone-scales are thin and separate almost to the base as the cone opens. The dorsal surface of the cone is finely wrinkled, rarely has warts on it and the larger cone-scales are angled to a broad apex while the small cone-scale is very slender, with little taper towards the tip. The height and shape of the columella are both variable but never three-lobed. *C. columellaris* is a single stemmed tree growing up to 18m and often has distinctly bluish-green foliage.

Although *C. columellaris* and *C. preissii* can usually be separated using cone morphology, there is considerable variation. Some individuals or populations may be very difficult to assign to a species, and there is evidence to suggest that these two species may represent extreme forms of a single taxon (Adams, 1982; Pillman, 1975). However, the taxonomy of *C. columellaris*, *C. preissii* and *C. verrucosa* has been confused by the incorporation of *C. preissii* and *C. verrucosa* into a single

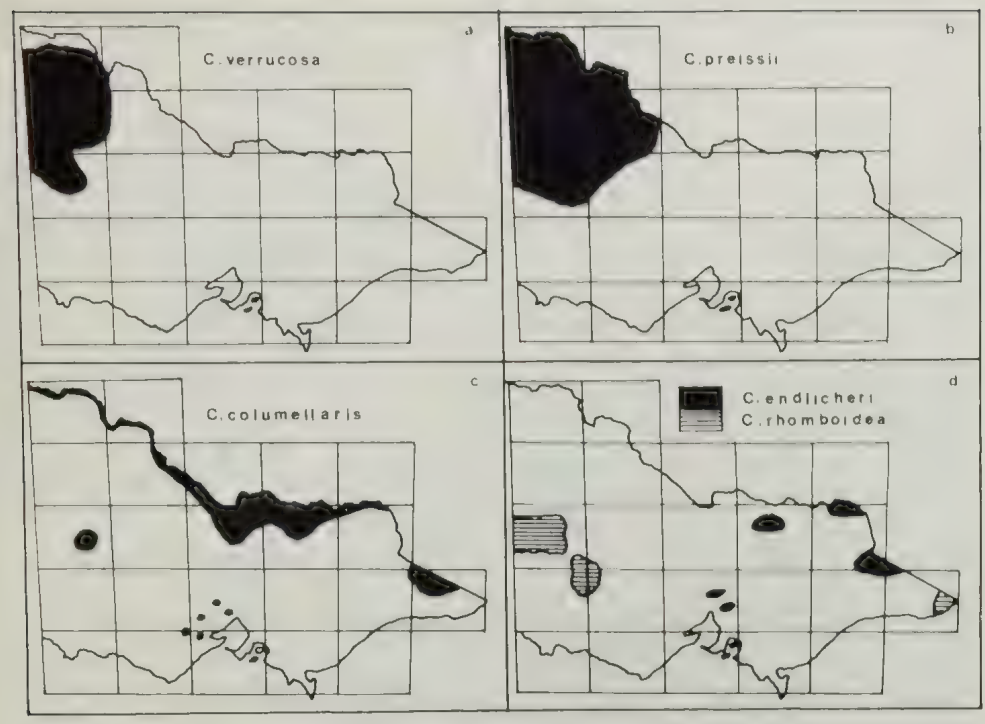


Fig. 1. Distribution of *Callitris* in Victoria. Grids follow Willis (1972).

taxon with three subspecies, *C. preissii* ssp. *preissii, C. preissii* ssp. *murrayensis* and *C. preissii* ssp. *verrucosa* (Garden, 1957), and the suggestion that *C. columellaris* hybridizes freely with some of these groups. There is no morphological or chemical evidence to support this classification, but it still causes great confusion in interpreting the conflicting species distributions (eg. Boland *et al.* 1984; Boomsma, 1981; Costermans, 1981; Garden 1957; Willis, 1962).

Callitris columellaris is a particularly interesting species in Victoria because of its distribution. The species grows extensively in South Australia, western New South Wales and along the Murray River, although confirmed instances of the species are rare downstream of Boundary Bend. The species also occurs in some spectacular stands in the rocky hills along the Snowy and Deddick Rivers in Victoria. *C. columellaris* is also found among the rugged cliffs of Mt. Arapiles near Horsham, but there are no confirmed occurrences between this and the area immediately around the Murray River to the north, a distance of about 250 km (Fig. 1c).

The species again appears very close to Melbourne, in several small isolated pockets (Fig. 2). These scattered stands are to be found (1) on steep slopes just to the north of Bacchus Marsh; (2) overlooking the Werribee Gorge south-west of Bacchus Marsh; (3) in a large, healthy stand on the cliffs over the Leigh River near Bamganie; (4) as two very old and now degenerate trees on Jackson's Creek near the Organ Pipes National Park (Nicholls, 1942); (5) in a small stand overlooking the Moorabool River near Maude; and (6) a single small tree in the Dog Rocks Sanctuary at Batesford near Geelong. The trees from localities 5 and 6 have been reported as *C. preissii* (Beauglehole, 1983), but a study of the volatile oils of trees from all the above

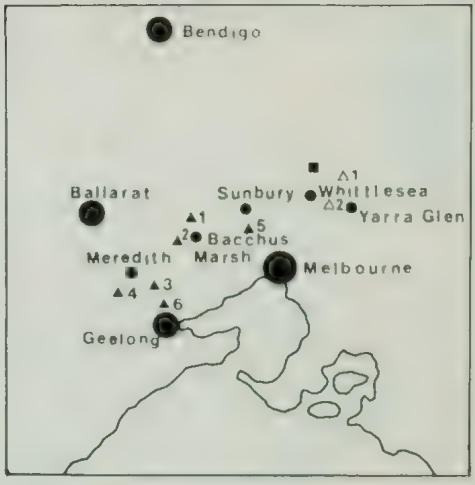
mentioned locations shows that trees from localities 5 and 6 are indistinguishable from *C. columellaris* (Adams, 1982). Beauglehole (1983) also records *C. preissii* from the Leigh River gorge near Bamganie, but this appears to be an error as the stand contains only *C. columellaris*.

The fourth species of *Callitris* found in Victoria is *Callitris endlicheri* (Parl.) F. M. Bailey (Black Cypress-Pine). This species has bright green foliage and small blackish cones with a prominent point on the back of the large cone-scale. Cones may be either clustered or solitary, with diameters less than 20mm. The columella is short, usually with either three or four lobes. The species occurs extensively on rocky slopes near Beechworth and around the Snowy River in eastern Victoria (Fig. 1d). A very large and disjunct stand is to be found at the Yan Yan Reservoir, just to the north of Melbourne (Fig. 2). It is not clear if this is a natural occurrence or the result of deliberate planting, but it seems quite possible that it does have natural origins.

Callitris rhomboidea R.Br.ex L.C.Rich. (Oyster Bay Pine), is the last of the five species to be found in Victoria. Until recently, its distribution was thought to be confined to the less fertile, sandy areas of the Little Desert, the dry rocky slopes of the Grampians and an occurrence in the Howe Range in the far East of the State (Fig. 1d).

The occurrence of *C. rhomboidea* has recently been confirmed in the Kinglake National Park, in the Dixon's Creek region, and further south along dry ridges into the Christmas Hills area to the north-east of Melbourne (Fig. 2). Here it grows as a scattered tree in open eucalypt forest in a habitat similar to that in which it is found in the Grampians.

The species is easily identifiable because, unlike the other four species, it has smooth bark, green to bluish-green foliage and clusters of small, shiny, angular cones with a very prominent point on the back of the large cone-scale. Cones are usually less than 20mm, the columella



▲ C.columellaris
1 Bacchus Marsh
2 Werribee Gorge
3 Maude
4 Bamganie
5 Jackson's Creek
6 Dog Rocks

■ C.endlicheri
Yan Yean

△ C.rhomboidea
1 Kinglake N.P.
2 Christmas Hills

Fig. 2. Locations of *Callitris* near Melbourne.

is short and often three-lobed, and the larger cone-scale broadens to a wide apex.

The occurrences of *C. columellaris* and *C. rhomboidea* near Melbourne are particularly important because of their geographical isolation from their main populations and it is interesting to speculate on the possible causes and length of time of their isolation. Major discontinuities often result from some climatic, or other change (Cain, 1944) and these populations may have been stranded, possibly many thousands of years ago, as the climate gradually changed. The intervention of Europeans may have altered these species' distributions. However, if this is true, it is surprising that no historical records exist

which mention the genus in these areas. These populations may have occurred by the chance dispersal of seed, however, *Callitris* seed is relatively large and is not naturally dispersed further than about 100m from the parent tree (Zimmer, 1942). Therefore the likelihood of seed being dispersed over considerable distances to a suitable habitat, and then the successful establishment of seedlings must be quite remote. However, once established, these populations may not be genetically isolated, as large amounts of *Callitris* pollen, presumably borne on winds from inland populations have been recorded in pollen traps on the Baw Baw Plateau (Strickland, 1980).

Although populations of all five species are adequately protected within National Parks and Reserves in Victoria, these isolated and possibly genetically distinct pockets of *C. columellaris* and *C. rhomboidea* must be considered under threat. The stands of *C. columellaris* are mostly on steep slopes subject to erosion and grazing. Grazing by domestic stock, and rabbits in particular, is responsible for the overall lack of regeneration in these populations, and it may be necessary for some areas to be securely fenced to exclude these animals, and a weed reduction program undertaken during the initial period of establishment, before sufficient numbers of seedlings can rejuvenate these populations. Farming practices, and simple vandalism, are also taking their toll of trees in some of the stands while in others the deaths of very old trees are leaving stands severely diminished.

In other areas such as the Kinglake National Park, wildfires, and land management practices such as fuel reduction burning, may pose threats to the survival of *C. rhomboidea*, as *Callitris* has no mechanisms to protect it against fire and it usually does not regenerate well, if at all, after fire.

These relic *Callitris* populations are of botanical and historical importance because of their geographic isolation, and should be conserved against the increasing pressures of agriculture and urbanization.

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The Pollination of *Gastrodia sesamoides* R.Br. in Southern Victoria

By David L. Jones*

A summary of the pollination of *Gastrodia sesamoides* was presented at the Orchid Symposium held as a satellite function of the 13th International Botanical Congress (Jones, 1981). This paper presents the pollination of that orchid in more detail.

During Oct. Nov. 1973 an extensive colony of *Gastrodia sesamoides* flowered on burnt ground in the Dandenong Ranges of southern Victoria. I was able to observe this colony on a day to day basis and witnessed the pollination on several occasions.

Orchid Biology

Gastrodia sesamoides is a saprophytic orchid found throughout the temperate regions of Australia and New Zealand. It grows in a variety of habitats including coastal heathland and sub-alpine bogs, but reaches its best development in the sclerophyll communities of south-eastern Australia. In these areas it grows as individuals or in loose scattered colonies, and in years of good rainfall may be extremely abundant. Flowering is greatly stimulated by fire and after such events many juvenile plants may be found flowering for the first time, usually as a thin weak inflorescence bearing 3-5 flowers. Being a saprophyte no leaves are produced and the species relies for its existence on a symbiotic relationship with an endophytic basidiomycete (McLennan, 1960). The orchid perennates in the ground as a large swollen, irregular brownish rhizome which in October-December terminates in a fleshy, brown peduncle rising from 25 to 90 cm in height and bearing up to 20 flowers in a loose raceme. This is at first nodding but straightens as the flowers open.

P.O. Box 261 Palm Beach Queensland 4221.

Floral Details

The flowers are tubular, about 15 mm long, more or less pendulous, a cinnamon brown on the outside and crystalline white within. They are non resupinate and entirely enclose the labellum. This organ during the first day of opening closes off the entrance to the flower but then moves into a position where entry by an insect can be effected. The labellum is a thin structure with a sharp flexure near the middle and a raised wavy yellow callus that coalesces at two points; the first near the entrance to the flower and the second near the labellum base. The column is curved and elongated with the sunken stigma situated at the base near the column foot while the anther is apical and near the entrance to the flower. The rostellum protrudes towards the base of the flower and is sticky on the lower surface only and connected to the basal stigma by vascular strands. The pollinia are four in number, friable, dark orange and not attached to a viscidium. Details of the plant and flowers are illustrated in Nicholls (1969, plate 350).

Pollination Syndrome

Gastrodia sesamoides has a very efficient pollination mechanism as witnessed by the abundance of the species and the number of capsules produced after flowering. The flowers possess a very pleasant and readily diffusable, spicy perfume which becomes noticeable at about 15°C and is very strong at 25° to 30°C. This perfume attacts the insects to the flowers and reward is provided in the form of a fine, sugary pseudopollen produced from the callus of the labellum. No nectar at all is produced by these flowers.

Each flower lasts 2-3 days and usually only three to five are open on the raceme at

any one time. Hence each plant may flower for up to three weeks depending on weather conditions. Not all plants in a colony emerge at the same time so that the species may flower for up to two months in any one area. All of these factors including the growth in loose colonies are part of the orchid's pollination syndrome.

Insect Behaviour

The orchid is pollinated by a small native bee in the genus *Exoneura* (family Anthophoridae, subfamily Xylocopinae, tribe Ceratinini). This species is a very common, partially social bee which collects and carries pollen in between the hairs of the hind legs. Nests are excavated into pithy stems and the larvae are fed progressively by the mother. This bee is peculiar in that the larvae live together and not in separate cells as in almost all other bees. The adults are about 10 mm long with a conspicuous reddish abdomen and feed from a wide range of plants.

The bees flew into the wind to the orchid flowers and hovered briefly in front of a flower before landing on the platform formed by the fused lateral sepals. After a perfunctory probe with the mouth parts the bee either entered or flew to another flower. Entry to the flowers is upside down from the top and the bee feeds initially on the first part of the callus where pseudopollen is produced. Probing here was usually brief and the insect then moved deeper into the flower, to the second part of the callus where much more time was spent. In all each bee was in the flower for 30-60 seconds. Because of the tubular nature of the flower it was difficult to see what was happening, however the insects were not easily disturbed and the flower could be manoeuvred with them inside. They appeared to scratch at the callus as active leg movements could be seen. Labellum movements due to the thin labellum and its flexure near the middle also occured and were caused by pressure exerted by the insect at it fed on the pseudopollen. When satiated, the insect turned around completely inside the base of the flower and emerged head first but upright. In so doing it contacted first the rostellum where it thorax was smeared with glue and then the anther where it received pollinia on the smeared patch. After a short time the glue dries and cements the bright orange pollinia firmly to the insect, rendering it very conspicuous.

Pollen deposition on the stigma could occur during the up and down feeding movements of the insect or during the turning manoeuvre prior to exit from the flower. After emergence the insect often remained at the entrance to the flower for some moments assiduously cleaning the mouth-parts and forelegs. On a few occasions the insects were observed to leave the flower after a brief visit lasting only a few seconds indicating that little was offered by that flower.

Experimental

A number of labella from freshly opened flowers and flowers that had been visited by insects were collected and compared microscopically. Those from the fresh flowers contained an abundance of pseudopollen, while little pseudopollen was left on labella from old flowers after the feeding of the insects. The pseudopollen is obvious as a fluffy yellow crystalline material particularly on the rear part of the callus where it can be scraped off in quantity. That on the front part of the callus is not as obvious but can be seen when the surface is disturbed.

A quantity of the pseudopollen was collected and examined under the microscope where the individual grains were seen to be rounded or elongated, with a number of granular inclusions. When treated with iodine in the standard starch test the granules blacken indicating that the pseudopollen contains a high level of starch. A similar test on the orchid's pollen was negative. Samples of pseudopollen from the front and rear labellum callus were identical to each other in structure and starch content. It was noticed in some samples that the iodine took time to

penetrate as if a waxy outer layer surrounded each granule. Scrapings from the hind leg of the pollinator showed a mixture of pollen from a variety of other plants and pseudopollen from the orchid to be present indicating that the insects do actually collect this material while in the flower as well as feeding on it.

Transverse sections were made through the callus of the labellum, stained and examined under the microscope. These showed that the pseudopollen is produced as a continuous succession of uniform cells and bubbles off the surface in a manner similar to callus cells produced in tissue culture or from the base of cuttings.

Post pollination

After pollination the pendulous ovary of *Gastrodia sesamoides* becomes erect and swells rapidly until seed dispersal some 4-6 weeks after pollination. A survey of the plants of the orchid in the area showed that 67% of the flowers were pollinated. Pollination only occurs on warm days and as there are often long periods of cool weather during flowering the spread of flowers on each plant and of flowering within each colony ensures a satisfactory result.

Acknowledgements

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A Technique for Trapping Under the Snow in Alpine Environments

BY IAN MANSERGH*

Introduction

At least six species of small mammal are known to occur in the alpine and subalpine region which covers less than 0.1% of mainland Australia. Although Osborne *et al.* (1979) have successfully trapped Dusky Antechinus *(Antechinus swainsonii),* Brown Antechinus *(A. stuartii),* and the Bushrat *(Rattus fuscipes)* during winter by digging through the snow to lay traps, the activity of native animals in the subnivean (undersnow) space is not well known; the problem of access to the subnivean space limiting some studies to the snow-free period (eg. Dickman *et al.* 1983).

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In a current study of the Mountain Pygmy Possum *Burramys parvus* (the only Australian mammal restricted to the alpine and subalpine region) it became apparent that trapping the subnivean space was necessary to delineate winter activity. Overseas studies had shown that a high mortality of trapped animals could be expected through trapping in the snow (Beuch, 1974). Because *Burramys* is recognised as a vulnerable species, a high trap-death rate was unacceptable, so new trapping techniques had to be explored.

In the northern hemisphere, several workers have examined the problem. Larsson and Hanson (1977) in Sweden, Iverson and Turner (1969) in Canada and Beuch (1974) in USA have developed methods for trapping under the snow, but

in each case involving relatively expensive structures. Fay (1960) in Alaska and Keller *et al.* (1982) in Idaho, developed cheaper techniques with the use of metal and plastic drums respectively. However, neither provided acceptable methods in the present context, and it was the work of Carron (pers. comm.) with 60 litre oil (metal) drums at Mt. Kosciusko (NSW) which provided insight for the development of the technique described here.

Subnivean Access

Subnivean access was provided by the winter placement of 205 litre drums which had both the tops and bottoms removed, the tops were retained as lids and attached to the drums by the use of plastic rope (Fig. 1). The lower portion of the drums had a plastic skirt 0.6m attached (Figures 1 and 2), to reduce or eliminate snow entrance to the area under the drum. Drums were tied to trees in the vertical position. The area of snow free space allowed the placement of up to 4 (usually 3 during present study) Elliot type A aluminium traps. To avoid mortality of animals, wood wool (shavings) were placed in the traps and each trap was baited with walnut and placed in a plastic bag. All traps were checked as early as possible the day after setting. Maximum and minimum thermometers were used to record daily temperature extremes. The total cost of materials (drum, plastic skirt and rope) was $26 — (April 1984).

Results

The complete results of the winter study will be presented elsewhere (Mansergh and Scotts in prep.). However, results of the survey relevant to the present examination of techniques are as follows:

1. Seven hundred and fifty trapnights were completed at 11 locations, July-October 1982-4; with a trapping success of 21%: *R. fuscipes*, (16.9%); *A. swainsonii* (4.1%). Apart from *Burramys* these species were the only species likely to be encountered in the area surveyed; western slopes of Mt. Higginbotham.
2. Mean trapping success per night was 23.0 ± 15.2%.
3. Animal mortality was zero during the survey.

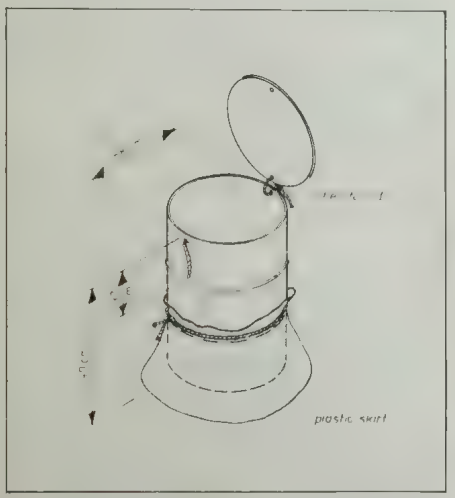

Fig. 1. Diagram of modified 205 l drum used for subnivean access for small mammal trapping.

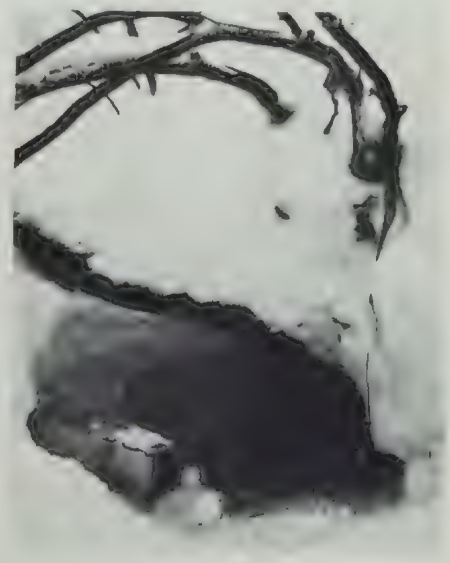

Fig. 2. Trapping drum *in situ* September 1984, snow is 1.5m above drum.

4. During the winter of 1984 some of the drums were up to 1.5m under snow (ie. snow depth above ground level was 2.4m).
5. At several localities all available traps (3) were occupied on one night.
6. The daily maximum-minimum temperatures (July-August 1984) recorded inside the drum at ground level ranged from + 2.7° to -3.0°C, at 1m above ground from +4.0°C to −3.0°C. In contrast, ambient temperature at 2m above ground level ranged from +11.5°C to −5.0°C.

Discussion

The method described appears to be suitable for trapping in the subnivean space with minimum risk of animal mortality. The trapping success is equal to or better than previous studies, one example being that of Osborne *et al.* (1979) who had a trap success rate of 9.7% (*R. fuscipes* 1.5%, *A. swainsonii* 5.1% and *A. stuartii* 3.1%) in 196 trap nights in July 1978.

Mansergh (1984) trapped the present study area during the non-winter period with a trapping success of 21.9%, of which 17.5% was *Burramys*. If *Burramys* had the same trappability over winter as in summer, the present efforts would have yielded approximately 100 encounters (Mansergh, 1984). In the natural environment, *Burramys* probably enters "ecological hibernation" during winter; i.e. if aroused from periods of torpor, activity is confined to feeding from food caches, presumably close to the nest (Dimpel and Calaby, 1972). Certainly, winter activity (if any) is vastly different from the non-winter activity as expressed in trapping success.

The average trapping success for the two species encountered during winter (*R. fuscipes* and *A. swainsonii*) was greater than over the non-winter period. This may be due to food shortages over winter as a net decrease in body weights was observed (Mansergh and Scotts, in prep.). Also, Dickman *et. al.* (1983) have found invertebrate prey to be less abundant over winter in comparable habitats.

Burramys habitat (rock screes; Gullan and Norris 1981) allows the full adoption of this technique, however, in other areas (flat substrate) legs attached to, or holes made in, drums may be useful in order to provide access to the snow-free space where the traps are laid. Clear identification of the sites is necessary, tags on trees or a 2.5 m stake is recommended. Furthermore, in extreme conditions, the moveable mechanisms in the Elliot trap should be greased. The diameter of the drum (58 cm) allows for placement of several traps. This is a definite advantage over a 60 litre drum which only allows one trap to be used.

Dimpel and Calaby (1972) found that with a snow cover greater than 45 cm, temperature at ground level never fell below 0°C, however, when snow depth was less than 40 cm, temperature at ground level approached ambient temperature. During the present study temperatures at ground level (even under 2m of snow) did fall below 0°C, however, temperature range within the drum was almost always less than the range of ambient air temperature. The drums appear to make the immediate space colder than it would otherwise be. Insulation is a possible adaption that future researchers may consider.

Acknowledgements

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The Devonian Tabulate Coral *Pleurodictyum megastoma* McCoy in the Heathcote District

By J. V. Neil*

Introduction

The fauna of the Early Devonian Mt. Ida Formation of the Heathcote District has recently been listed (Neil, 1982). The most widespread taxon is *Pleurodictyum megastoma* McCoy 1866. Because of its common occurrence, this taxon gave its name to Unit 3 of the Mt. Ida Formation as the "Pleurodictyum Beds". This tabulate coral is distinctive in form, with its polygonal corallites being easily detected in the field, even when only fragments of the original colony are preserved. This note is based on a collection of nearly thirty specimens from eleven of the localities shown on the plan in the paper referred to above (Neil, 1982, Fig. 2). As previous references to this ubiquitous Heathcote fossil are limited, it was felt that a general note would be of interest to palaeontologists and field naturalists.

The earliest references are by McCoy (1866, 1867a, 1867b). Subsequent references by Etheridge (1878) and Foerste (1888) are very tentative. Dun (1898) described and figured *Pleurodictyum* sp. (? *P. Megastomum* McCoy MS). This was the first substantial description of the species, so that Chapman (1903) in describing and figuring Victorian specimens, classifies them as *P. megastomum* Dun. Talent (1963) has given a full synonymy of *Pleurodictyum megastoma*. The description given by Talent (1965) of Heathcote specimens is brief and limited to a few diagnostic characters only.

Since McCoy's description has priority over that of Dun, the correct designation of the species is that used by Talent. In addition to the 1903 description, Chapman also described and figured this coral in 1921. Withers (1932) analysed the growth patterns of *P. megastoma*, using specimens from Kinglake and Woori Yallock. Gill (1942, 1948, 1950) has described specimens from Lilydale and Tasmania. For New Zealand occurrences, Allan (1935) referred specimens from the Reefton Beds to *P.* cf *problematicum* Goldfuss, but indicates that Benson (1923)

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recorded *P. megastomum* Dun (sic) from the Baton River Beds.

To date, the type material of *P. megastoma* McCoy has not been identified.

The Heathcote Collection

The twenty-nine specimens referred to in this note occur as moulds in sandstone in Units, 1, 2 and 3 of the Mt. Ida Formation. Significant data concerning them are

Table 1. *Pleurodictyum megastoma* specimens from Heathcote.

A	B	C	D	E	F	G
108690	R25	5.1	—	—	—	*Ephebic (Epitheca only)*
691	R25	2.1	11	0.7	0.9	Ephebic
692	R25	1.5	2	0.6	1.1	Ephebic
693	R25	2.0	12	0.7	0.8	Ephebic
694	R25	1.6	—	—	—	? (Epitheca only)
695	R25	2.3	10	0.5	0.8	Ephebic
696	R25	1.7	8	0.6	1.0	Neanic
697	R25	2.2	9	0.7	0.9	Ephebic
698	R25	2.3	5	0.7	0.8	Gerontic
699	R25	2.1	7	0.5	1.0	Ephebic
108700	R25E	1.7	7	0.5	0.6	Neanic
701	R25E	1.8	4	0.6	1.0	Ephebic
702	R25E	1.3	4	0.6	1.2	Ephebic
703	R25E	1.2	6	0.5	0.7	Neanic
704	R25E	4.1	—	—	—	*Ephebic (Epitheca only)*
705	R25E	2.8	22+	0.5	1.0	Gerontic
706	R30	1.4	8	0.4	0.6	Neanic
707	R30	1.4	5	0.4	0.6	Neanic
708	R30	2.5	15	0.5	1.0	Ephebic
709	R31S	3.4	14	0.9	1.3	Ephebic
108710	R31S	3.5	?	?	?	Gerontic
711	R9	3.0	10	0.5	0.9	Gerontic
712	R9	1.8	10	0.5	0.8	Ephebic
713	R21	2.3	13	0 5	0.8	Ephebic
714	D10	2.5	13	0.6	0.8	Gerontic
715	R28	4.5	40	0.5	1.3	Gerontic
716	R54	2.6	7	0.8	1.2	Neanic
717	H25	1.9	6	0.5	0.8	?
718	H25	2.0	—	—	—	? (Epitheca only)
719	H25	—	Specimen lost			—

A Specimen number (Museum of Victoria). B Locality number. C Size of corallum. Maj. diam. cm. D Number of corallites. E Smallest corallite. Maj. diam. cm. F Largest corallite. Maj. diam. cm. G Growth stage (After Withers, 1932).

summarised in Table 1. The specimens are lodged in the collections of the Museum of Victoria, and the catalogue numbers are shown in the table.

The preservation of the specimens is generally average to good, considering the nature of the matrix, and the generally poor quality of preservation of Heathcote fossils. However, since all are moulds, the amount of information which can be deduced from the material is limited. Techniques for the preparation of epoxy casts of the moulds of intricate fossils such as these are available, but have been beyond the scope of the writer's facilities up to the time of writing.

Most specimens come within the range of size established by previous workers for individual corallites and corallum. Corallite size ranges between 0.4 cm and 1.3 cm, though it is difficult to establish whether the measured diameter is always normal to the axis of the corallite. The coralla range between 1.2 cm and 5.1 cm in diameter, though the smallest is probably not entire. The number of corallites in specimens which can be identified as entire runs from 7 to 40. With the possible exception of Specimen NMVP108715 (Figs. 1, 2 and 3) which will be described below, the material is typical of this species as it occurs in Australia. The largest corallites are close to the size specified by McCoy in the original description.

The growth stages represented by this collection are mainly mature to gerontic, using criteria given by Withers (1932), although six specimens are in the neanic stage. Several basal epitheca are preserved (see Fig. 3), and show characteristic concentric, wavy ridges.

Fig. 1. *Pleurodictyum megastoma* McCoy Specimen No. 30. Mould of corallum x 1.2.

Discussion

The number of specimens in the collection is insufficient to enable useful inferences to be drawn about variability between the various locations. Similarly, the distribution of growth stages appears to be random. However, the collection does tell us something about the occurrence and variability of the species in broad terms.

Three of the epitheca included in the collection clearly show the animal to which the coral was attached (strophеodontid brachiopods, and a bivalve mollusc). The discoidal shape of the majority of the coralla suggests that strophomenid brachiopods, with their broad, flat shells, may have formed the commonest source of attachment. Brett and Cotterell (1982), referring to the substrate of *Pleurodictyum*, report up to sixty different skeletal substrates, though the American form, *P. americanum*, displays a preference for gastropods. In a recent paper, Fuchs and Plusquellec (1982) have studied the relationship between the European species *P. problematicum* and the annelid *Hicetes*. Brett and Cotterell had also established a high frequency of association, and suggested that the *Pleurodictyum* — *Hicetes* relationship was independent of the substrate. Fuchs and Plusquellec maintain that the relationship is part symbiotic and part parasitic, and effectively make it a defining characteristic of the genus *Pleurodictyum*. There is no evidence or mention of the combination in the literature of *P. megastoma*, but further investigation of better preserved material is required before a definitive answer can be given as to whether the association occurs with the Australian material. In view of the "classic" nature of the association with the European material (Gall, 1983), it is somewhat surprising that some kind of annelid-coral relationship has not yet been found.

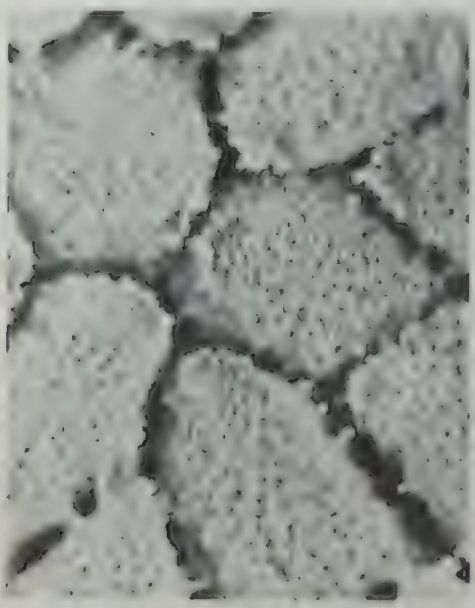

Fig. 2. *Pleurodictyum megastoma* McCoy Specimen No. 30. Central corallites x 4.5.

Brett and Cotterell also comment on the wide morphologic range of the corallum of this genus, and figure forms ranging from large, hemispherical, flat-based types, to conical and bi-conical forms, and irregular or aberrant morphotypes. The Heathcote collection displays some variation in the form of the corallum, though the hemispherical, flat-based type predominates.

The corallites in the best-preserved specimens (MV P108690, -691, -692, -694, -697, -698, -700, -711, -715) show clearly that the septa consisted of rows of spines, as was suggested by Dun (1898), and later confirmed by Philip (1962). Since the corallites diverge and increase in size from the base of the corallum, those forming the outer margin tend to be elongated, whilst those near the centre from which the colony developed are more regularly polygonal.

The Largest Specimen

(MV P108715) One of the specimens, collected from Locality Redcastle 28 (see Neil, 1982, Fig. 2) is noteworthy because it shows 40 corallites (Figs. 1 and 2) forming an almost circular corallum. The initial

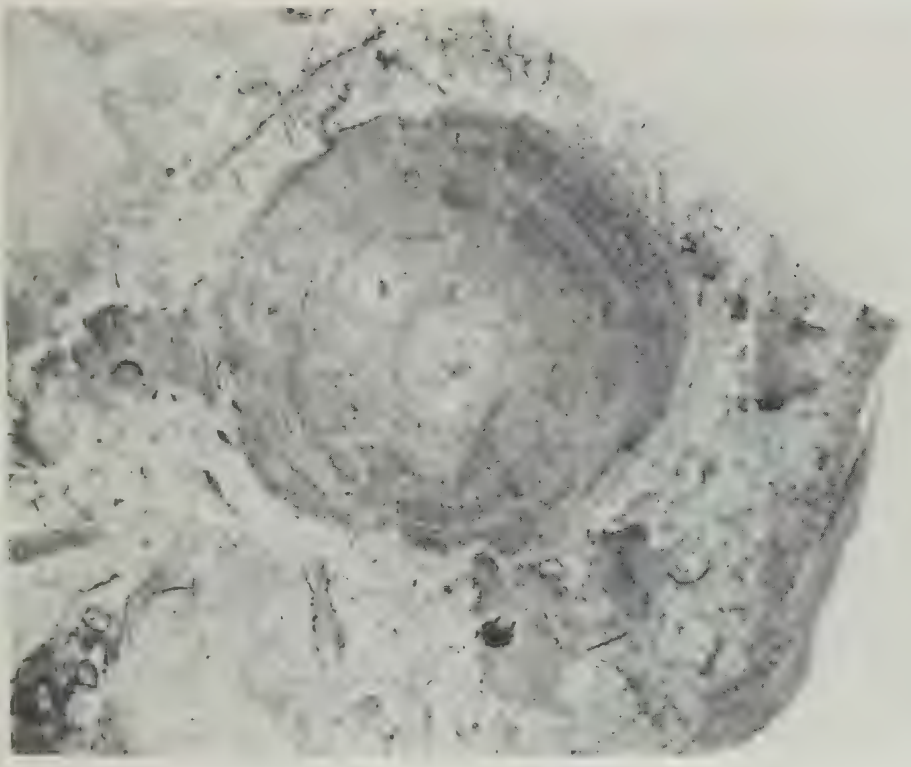

Fig. 3. *Pleurodictyum megastoma* McCoy Specimen No. 30. Mould basal epitheca x 1.2.

corallite ("protocorallite" in Fuchs and Plusquellec's terminology) is off-centre, which suggests either that growth was more vigorous on one side than the other, or that the plane of the basal epitheca was not normal to the axis of development of the colony. The elongated shape of the corallites on one side, compared with their more regular shape on the other, is open to either interpretation. The number of corallites is the largest yet recorded for this species. Gill (1942) recorded 28. However, *Pleurodictyum* in Europe and North America often shows colonies with many more corallites. The locality is in Unit 1 of the Mt. Ida Formation, whereas most of the others are from Unit 3.

Conclusions

The suggestion made by Philip (1962), Williams (1964) and Brett and Cotterell (1982) concerning *P. megastoma* (for the former two) and the genus *Pleurodictyum* (for the latter) are confirmed by this collection of specimens from Heathcote. They propose that variations in the size of the corallites between specimens reflect ecological control. It is unlikely that these variations are of specific significance, but rather represent a combination of growth stages, and ecophenotypic response. Consequently, the range and variation in corallum and corallite size and shape can be regarded as infra-specific, and all the specimens can be attibuted to *Pleurodictyum megastoma* McCoy 1866. The occurrence of one specimen in Unit 1 of the Mt. Ida Formation (latest Silurian?) is not of particular significance, since the stratigraphic and geographic boundaries of these units is still the subject of debate.

Acknowledgements

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Naturalist Note

Peter Luke of Swan Hill writes ". . . recently while working at Robinvale, I experienced a remarkable sight. I was engaged in lopping large cottonwood trees when I saw a Red Wattlebird's nest on a horizontal branch about 4 metres from the ground and 2-3 metres out from the main trunk. On inspection the nest contained two young. I decided to leave the branch intact and lop the rest of the tree, which involved cutting all branches back to the main trunk. I returned about an hour later to see if the parents had returned to the nest. They had, and amazingly, the nest had been shifted back close to the main trunk in a small fork intact and in perfect order. Has this shifting of a nest ever been reported before?"

Some Observations on Reproduction in the Three Lined Skink *Leiolopisma trilineata*

By T. P. Morley*

This paper reports observations on reproduction in two specimens of *Leiolopisma trilineata* from south-eastern South Australia. Reproduction in this species has been recorded only from dissected museum specimens (Greer, 1982 as *Leiolopisma duperreyi*), and three other brief observations (Rawlinson, 1974; Rounsevell, 1978; Shine, 1983).

Leiolopisma trilineata is a small striped lizard of the family Scincidae whose range is divided into two allopatric populations, one in south-eastern Australia and the other in south-western Australia (Cogger, 1983). Greer (1982) recognized the W.A. population as distinct from the south-eastern form. He chose to name the S.E. population *L. duperreyi*, and restricted the name *L. trilineata* to the W.A. form. This move has been recognized by some (Wells and Wellington, 1983), but not by others (Cogger, 1983; Cogger *et al.*, 1983). Thus, some controversy exists as to the status of these populations. Until this taxonomic issue is resolved I have chosen to retain the name *L. trilineata* for the specimens from South Australia, because all other references used in this study (Rawlinson, 1974; Rounsevell, 1978; Shine, 1983) concern specimens from the S.E. population and refer to them as *L. trilineata*.

Two Three Lined Skinks, *L. trilineata*, were collected near Penola, South Australia (37°23'S, 140°50'E) (South Australian Museum, R23772-73) on 5 January, 1983. Both specimens were females, snout-vent lengths 55mm and 50mm, respectively, and both appeared to be gravid. The two specimens were housed in a small (25cm x 25cm) vivarium with a substrate of beach sand. Mealworms and water were constantly available.

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On 8 January, 1983 each female laid five eggs. Egg laying was only observed for R23773. The first egg was laid at 1946 hrs. and the last at 2043 hrs., at intervals of 9-17 minutes ($\bar{x}$ = 14.3, S.D. = 3.6 mins.). Length and width of all eggs was about 12mm x 6mm.

Each clutch of eggs was placed on paper towelling, moistened with rainwater, and put in separate plastic bags, loosely tied. The eggs were incubated at room temperature (22-24°C). Temperature was not controlled but the paper towelling was checked daily to ensure it remained moist. Three eggs in one clutch (R23772) became mouldy and were discarded.

The first neonate (clutch R23773) emerged from it's egg on 14 February, 1983 after 37 days incubation. The remaining six eggs hatched the following day. After splitting the egg shells, juveniles remained in the eggs for a varying amount of time, from 45 mins. to 9 hrs., before full emergence. One neonate, from clutch R23773, died four hours after emergence. Average length of neonates = 22.7 ± 1.0 (range 22-24) mm.

Typical of adult *L. trilineata*, from the south-eastern population, juveniles were boldly striped dorsally and white below (Fig. 1). An orange patch on each side of the head, between the ear and the eye, extended down to the upper labials, but not below them, on each specimen.

Clutch sizes reported herein were about the same as the average clutch size for Tasmanian *L. trilineata* (5.5) reported by Rawlinson (1974) and specimens from Coree Flats (4) reported by Shine (1983). Greer (1982) gives a mean of 4.8 as a clutch size for *L. duperreyi*.

Egg sizes reported for *L. trilineata*, by Rounsevell (1978), were larger than those reported herein, however, his eggs were collected in the field and the time since

parturition was unknown. Other authors have shown that eggs increase in size and volume during incubation. (Bustard, 1966; Mitchell, 1959; Smith and Schwaner, 1981).

Rounsevell noted an orange patch on the throat of juveniles, but the orange coloration reported here did not extend to the gular region. Greer also reported a "rosy orange" throat color on larger specimens, that was not apparent on any specimens observed at Penola.

Acknowledgements

I am grateful to Dr. Terry Schwaner for his constructive criticism and to the National Parks and Wildlife Service of S.A. for the permits.

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Fig. 1. Juvenile No. 6 the day after emergence.

Small Mammals in the Anglesea — Airey's Inlet Area of Southern Victoria — a Post Fire Survey

By B. A. Wilson* and D. J. Moloney*

Introduction

The fires of the 16th February 1983 burnt 39,000 hectares of the eastern Otways including the Anglesea-Airey's Inlet area along the Great Ocean Road between Geelong and Lorne. The initial damage was severe leaving a landscape of devastated houses, blackened trees and bare ashen ground. Previous to the fires several studies had been carried out in the area on small mammal ecology (Jessop, Bourne and Wilson, 1981; Kentish, 1982; Kentish and Bourne, 1982; Kentish 1983; Wilson, 1983; Wilson, Bourne and Jessop, 1984). These studies provided a basis for a study of the effects of bushfire on small mammals.

This paper is a preliminary report on the status of small mammals in the Anglesea-Airey's Inlet area based on a trapping survey carried out between September 1983 and February 1984. This work is part of a long term study in which post fire revegetation is also being investigated. The results of the initial revegetation survey will be reported separately.

The study area extends from Moggs Creek in the west to Point Addis and inland to the International Harvester testing ground (Fig. 1).

Methods

Animals were trapped using Elliott type B metal traps (34 x 10 x 10 cm) (Elliott Scientific Equipment, Upwey, Victoria) and cage traps (36 x 20 x 17 cm) (Gordon Wire Works, Kew, Victoria). The bait used was a mixture of peanut butter, honey and rolled oats. Traps were set for 3-4 nights and checked each morning.

Forty-three have been trapped. Sites were selected at random in some cases and in others on the basis of prefire small mammal data from our previous studies. The sites included areas of native vegetation (unburnt and burnt areas) and mine rehabilitation areas (unburnt) surrounding the Alcoa coal mine at Anglesea (Fig. 1).

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Results

Regeneration of the flora in the study area appears to have been swift with revegetation resulting from soil stored seeds and root stock. Fungi formed an orange-red carpet over the burnt ground shortly after the fire and grass trees (*Xanthorrhea australis*); sedges (*Gahnia* sp.) and common bracken (*Pteridium esculentum*) were the first plants to show signs of new growth. *Acacia* seedlings were emerging through the burnt soil and epicormic growth was seen at the base and on trunks and branches of *Eucalyptus* spp.

Ten plant community types in which trapping has been carried out are described briefly below.

1. Coastal heathland — dominated by *Leptospermum myrsinoides, Banksia marginata, Casuarina pusilla*; sparsely treed e.g. *E. obliqua*, grasses and sedges such as *Lepidosperma* spp., *Amphipogon strictus*.
2. Iron Bark Forest — stands of *E. sideroxylon* and *E. cypellocarpa* with a bare understorey containing seedlings of *Acacia verticillata, Goodenia ovata* and *Pultenaea daphnoides*.
3. Woodland/closed heathland — *E. obliqua, E. radiata, E. baxteri* trees with closed heathland understorey of species as in (1.).

4. Open woodland/heath understorey similar species to (1.) with *E. willisii, E. baxteri* and lower, sparser understorey cover.
5. Swamp/heathland — permanent swamps with woody dicots such as *Melaleuca squarrosa, Leptospermum juniperinum*, and sedges e.g. *Baumea juncea, Empodisma minus* and *Schoenus breviculmis.*
6. Fern gully — Ferns (*Cyathea australis, Pteridium esculentum*); *Tetrarrhena juncea*, seedlings of *Acacia* spp. and *Eucalyptus*, liverworts such as *Marchantia* spp.
7. Sand dune — *Leucopogon parviflorus, Melaleuca squarrosa, Acacia* spp., *Swainsonia lessertifolia, Helichrysum paralium.*
8. Mixed Eucalypt/Pine — *E. baxteri, Pinus radiata* with sparse understorey of *Pteridium esculentum*, grass spp.
9. Forest/heath understorey — tall stands of *E. ovata* with heath understorey of *Acacia myrtifolia, Leptospermum myrsinoides, L. juniprinum, Lepidosperma* spp., *Pteridium esculentum.*

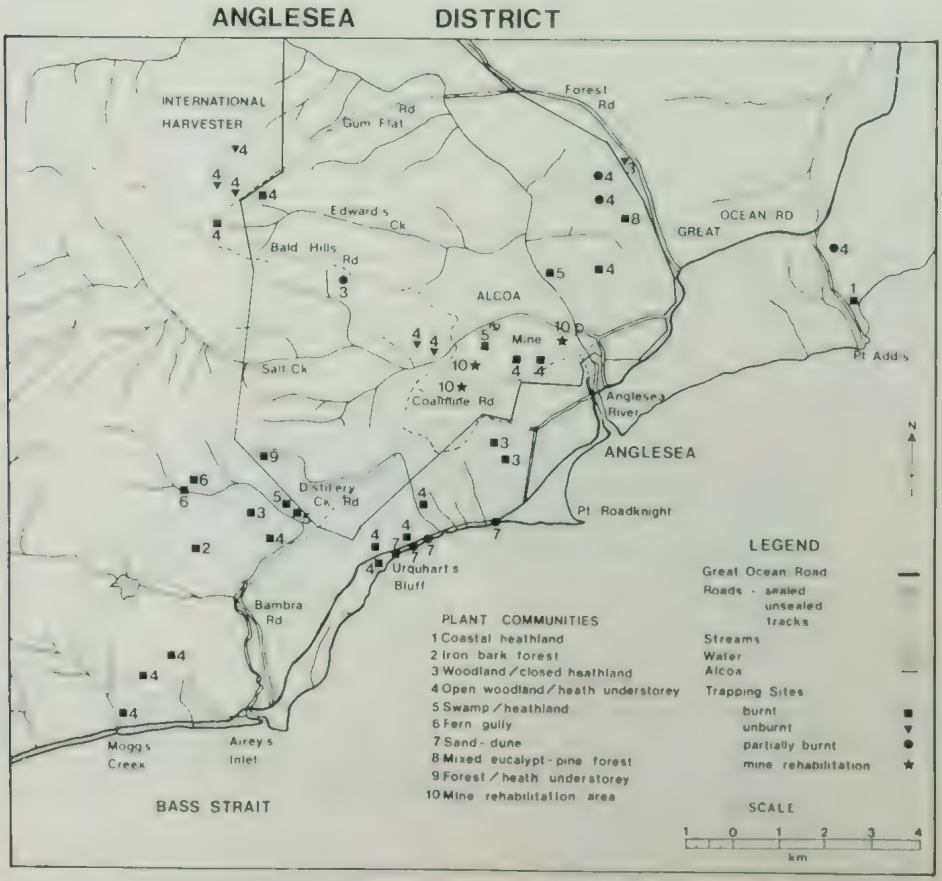

Fig. 1. Location Map — east to west Mogg's Creek to Point Addis, north to International Harvester testing grounds

10. Mine rehabilitation area — the small tree and shrub layer consisted of *Eucalyptus viminalis* and *Leptospermum juniperinum*. *Danthonia setacea* and *Poa* and *Stipa* spp. were the main grasses while the lower herb layer was *Opercularia varia*, *Gnaphalium involucratum* and *Helicrysum obtusifolium*.

A total of 6,215 trap nights were conducted. They were distributed as follows: 3322 in burnt sites, 1496 in unburnt sites, 842 in partially burnt sites and 555 in mine rehabilitated sites. Species and the numbers captured are summarised in Table 1. Partially burnt sites were designated as such if burnt and unburnt areas were within the sites, or if the site was subject to a light burn, as was the case in sites which had been burnt in previous fires.

The overall trapping success was 3%. The trap success rate in burnt sites was 3.3%, in unburnt sites 1%, in partially burnt sites 8% and in mine rehabilitation sites 0.2%.

The small mammal species captured were: *Antechinus minimus* (swamp antechinus); *Antechinus stuartii* (brown antechinus), *Cercartetus nanus* (pigmy possum); *Isoodon obeulus* (brown bandicoot); *Mus musculus* (house mouse); *Potorous tridactylus* (potoroo), *Rattus fuscipes* (southern bush rat); *Rattus lutreolus* (eastern swamp rat); *Rattus rattus* (black rat).

Trapping success in the different plant community types is summarised in Table 2.

In addition to the small mammals captured on the sites the following species were either captured or observed: *Wallabia bicolor* (swamp wallaby);

Table 1. Animal captures in burnt, unburnt, partially burnt and mine rehabilitation sites.

Species	No. of individuals	Burnt sites n = 27	Unburnt sites n = 6	Partially burnt sites n = 7	Mine rehabilitation sites n = 3
Antechinus minimus	8 (14)	2 (3)	—	6 (11)	
Antechinus stuartii	19 (26)	16 (20)	3 (6)		
Potorous tridactylus	1 (1)	—	1 (1)		
Isoodon obesulus	1 (1)	—	—	1 (1)	
Rattus rattus	8 (8)	7 (7)	—	1 (1)	
Rattus fuscipes	7 (11)	2 (2)	—	5 (9)	
Rattus lutreolus	12 (13)	6 (6)	3 (4)	3 (3)	
Mus musculus	88 (113)	56 (70)	—	31 (42)	1 (1)
Cercartetus nanus	1 (1)	1 (1)			
Total number of individuals	145 (188)	90 109)	7 (11)	47 (67)	1 (1)

Numbers in parentheses represent the number of captures of individuals.

Table 2. Animal captures in different plant communities

Species captured	Plant community types 1 n = 1	2 n = 2	3 n = 5	4 n = 18	5 n = 4	6 n = 2	7 n = 4	8 n = 1	9 n = 1	10 n = 3
Antechinus minimus	–		–			–	8			
Antechinus stuartii	–	–	13	6						
Petaurus breviceps	–	–	–	1						
Isoodon obesulus		–	1		–	–				
Rattus rattus			1	1	–	–	1	–	–	
Rattus fuscipes	–		–	–	–		7	–	–	–
Rattus lutreolus		–	5	9	–	–	3	–	–	–
Mus musculus	–		9	32	–	–	46	–		1
Cercartetus nanus		–		–	1					
Total number of individuals	0	0	29	49	1	0	65	0	0	1

n = number of sites

Macropus giganteus (eastern grey kangaroo); *Tiliqua scincoides* (stumpy tail lizard); *Leiolopisma* spp. (lizard); *Pseudodonaja textilis* (brown snake); *Notechis scutatus* (tiger snake) and *Strepera graculina* (pied currawong).

Discussion

Observations of vegetation at trapping sites indicated that rapid regeneration was occurring after severe fire damage. Such rapid regeneration of Australian vegetation is attributed to the increase of nutrients in the soil (ash-bed affect) after fire, residual seed in the soil, seed released from woody fruits after fire and by regrowth from surviving vegetative organs (Gill, 1975; Purdie and Slayter, 1976; Gill, 1981; Ashton, 1981).

The trapping survey revealed a low overall trapping success rate. Burnt and partially burnt sites had higher trap success rates compared to unburnt sites and this was attributed to the large numbers of *Mus musculus* (Table 1). This is in agreement with previous studies where *Mus* appears quickly after an area has been disturbed by fire, clearing or mining (Newson *et al.*, 1975; Christensen and Kimber, 1975; Fox and Fox, 1978; Friend, 1979; Fox and McKay, 1981; Recher, Lunney and Posamentier, 1975). In such studies *Mus* was found to be an early colonist, with numbers increasing rapidly within a year after the disturbance, followed by an equally rapid decline in the following two years.

There was a low trap rate of *Mus* (1 individual) on the mine rehabilitation site. Previously a substantial *Mus* population occurred on these areas from March 1981 to March 1982 (Kentish, 1983). It is likely that changes in the vegetation structure such as a decrease in cereal grains, initially planted to stabilise the area, has been associated with the *Mus* decline. Since no other species was captured on these sites, it is unlikely that a species replacement has occurred. These alternatives are presently under investigation.

The higher capture rate (8%) in partially burnt sites is likely to be the result of more animals surviving the fire by seeking refuge in unburnt pockets of vegetation. On the sand dune areas it is probable that animals also escaped onto the primary dunes.

Although trapping intensity (i.e. number of sites trapped and number of trap nights) was different for each plant community type it was evident that more animals were present in Types 3, 4 and 7 — the woodland/closed heathland; open woodland/heath understorey and sand dunes respectively (see Table 2). As mentioned, this could be related to the fact that a number of the latter plant community trapping sites were either unburnt or partially burnt, thereby allowing a refuge for animals.

The trapping survey failed to locate two species which had been present in the area previous to the fire. The species are *Sminthopsis leucopus* (white-footed dunnart) and *Pseudomys novaehollandiae* (new holland mouse) (Jessop, Bourne and Wilson, 1981; Kentish, 1982; Kentish, 1983). The previously studied population of *P. novaehollandiae* at Anglesea was thought to be "an isolated remnant of the original distribution of this species in Victoria" (Kentish, 1983) and may not have survived due to low numbers at the time of the fire.

Although *S. leucopus* prefers mid seral stages, it does appear to require scattered mid-storey cover (Morton *et al.*, 1980; Kentish, 1983). The regenerating heath may not be suitable for this species. Unless remnant populations have survived in unburnt pockets it is unlikely to have survived in the area.

Although nine species of small mammals were captured over the whole study area, the number of species at selected sites, for which there is prefire data, showed a dramatic decline. No animals were captured on two burnt sites (Coalmine Rd.) which had previously supported six species (Kentish, 1983). Another burnt site which previously supported nine small mammal species (Jessop; Bourne and Wilson, 1981; Wilson, 1983) had only one *A. stuartii*. Future trapping studies will determine whether local extinction of species has occurred at these sites.

Reproductive activity was evident in most species. Female *A. stuartii* and *A. minimus* had pouch young or developed mammary tissue and first year juvenile young were also captured during the survey. The *I. obesulus* female and one *R. fuscipes* female had enlarged teats indicating breeding activity.

Conclusion

From this survey it can be concluded that *Mus* is an early colonizer in post-fire regeneration and that animals can survive if sufficient refuges are available to escape the fire such as unburnt pockets of vegetation.

Acknowledgements

This study was supported by a grant from the Ministry of Conservation. We thank Margaret Wark and Mary White for their botanical expertise and discussions and Graeme Morton and Margaret Lynch for their technical assistance.

The work was carried out under the provisions of scientific permits issued by the Fisheries and Wildlife Division, Victoria.

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Naturalist Review

The Banksia Book

By Alex S. George. Kangaroo Press in association with the Society for Growing Australian Plants NSW Ltd. (1984?) 240pp. $29.95.

This is a splendid book for the *Banksia* enthusiast. There are fine colour photos of all 73 species showing the flowerhead and leaf, habit of growth, and sometimes other features. Completing the pictorial information are large, clear line drawings of the fruiting-head and seed, often the seed-separator, a single follicle, flower or leaf, and a small map showing distribution. All plant drawings carry the degree of enlargement or reduction.

The text confirms and greatly adds to the visual value of this book.

The introduction includes a brief history, an excellent description of "what makes a *Banksia*" with diagrams of flowering and fruiting structures, information on cultivation, tables for easy reference, and the classification of Banksias.

Text to each species is likely to please both the layman and the professional botanist. Each begins with the source and meaning of the specific appendix, when and where discovered and by whom; then comes a full description — necessarily using botanical terms for conciseness and precision but almost all such terms are clearly defined in the glossary, followed by distribution, flowering period, cultivation hints and other matters.

Layout of the pages is pleasing, the seriffed type with good inter-line spacing is supremely legible (even in the Index), and the printing has retained many subtleties of tone in the colour plates. It is sad that the title page so clumsily lets down the standard.

There is a conspicuously serious error — omission of the publication date. A table on page 33 states that the last *Banksia* was named in 1984.

Providing reliable information and fine photography *The Banksia Book* is very good value at $29.95. Discount is available to FNCV members.

Margery J. Lester

GROUP EXCURSIONS

All FNCV members and visitors are invited to attend Group Excursions.

Botany Group

Saturday, 27th April. Kawarra Native Garden and Ferns of Olinda Forest.

Saturday, 25th May. Fungi. Leader: Garry Cheers.

Saturday, 22nd June. Royal Botanic Gardens.

Mammal Survey Group

June 8th - 10th (Queen's Birthday Weekend). BlackRange, Rushworth State Forest.

Geology Group.

Sunday 5th May. Blackwood: General History and Mining. Leader: Mr. Graham Love. (See under General Excursion notices for bus details).

(continued from page 46)

FIELD NATURALISTS CLUB OF VICTORIA

Report by Executive Council

In accordance with Section 270 of the Companies (Victoria) Code 1981, the members of the Executive Council submit herewith balance sheet as at 31 December 1984, and statement of income and expenditure for the year ended on that date, and report as follows:—

1. The names of the members of the Executive Council in office at the date of this report are as follows:—
   Miss W. Clark
   Mr L. Williams
   Mr N. Disken
   Miss M. Allender
   Mr B. Smith
   Mr B. Lobert
   Mr A. Thies
   Mr I. Faithfull
   Miss M. Potter
   Miss C. Shankly
   Mrs H. Stanford
   Mr W. Rocke
2. The principal activities and objects of the Club are to stimulate interest in natural history and to preserve and protect Australian Fauna and Flora. No significant change in the nature of those activities occurred during that period.
3. The net deficit of the Club for the year ended 31 December 1984 was $678 in the General Account. In addition surpluses were earned in the following Funds:—
   Building Fund $1,164, Publications Fund $6,962
   Excursion Fund $1,930 and Special Funds $829
4. The following transfers to and from Funds have been made during the year ended 31 December 1984:—
   From Club Improvement Account to General Account Surplus $466
   From Income & Expenditure Account to Club Improvement Account $1,973
5. The Club has issued no shares or debentures during the year.
6. Before the income and expenditure accounts and balance sheet were made out, the Executive Council took reasonable steps to ascertain what action had been taken in relation to the writing off of bad debts and the making of provision for doubtful debts and to cause all known bad debts to be written off and adequate provision to be made for doubtful debts.
7. At the date of this report the Executive Council is not aware of any circumstances which would render the amount written off for bad debts or the amount of the provision for doubtful debts inadequate to any substantial extent.
8. Before the income and expenditure account and balance sheet were made out the Executive Council took reasonable steps to ascertain whether any current assets (other than those current assets referred to in paragraph (6)) were unlikely to realize in the ordinary course of business their value as shown in the accounting records of the Club and, if so, to cause:—
   (a) Those assets to be written down to an amount which they might be expected to realize; or
   (b) Adequate provision to be made for the difference between the amount of the value as so shown and the amount that they might be expected to realize.
9. At the date of this report the Executive Council is not aware of any circumstances which would render the value attributed to current assets in the accounts misleading.
10. At the date of this report there exists no charge on the assets of the Club which has arisen since the end of the financial year and secures the liabilities of any other person and no contingent liability has arisen since the end of the financial year.
11. No contingent or other liability has become enforceable or is likely to become enforceable within the period of twelve months after the end of the financial year which, in the opinion of the Executive Council, will or may affect the ability of the Club to meet its obligations when they fall due.
12. At the date of this report the Executive Council is not aware of any circumstances not otherwise dealt with in the report or accounts which would render any amount stated in the accounts misleading.
13. The Club is prohibited from paying a dividend by its Memorandum and Articles of Association; consequently no dividend is recommended and no dividends have been paid or declared.
14. The Executive Council is of the opinion that the results of the Club's operations during the financial year were not substantially affected by any item, transaction or event of a material and unusual nature.
15. In the interval between the end of the financial year and the date of this report, no item, transaction or event of a material and unusual nature has arisen which is likely, in the opinion of the Executive Council, to affect substantially the results of the Club's operations for the next succeeding financial year.
16. Since the end of the previous financial year no member of the Executive Council has received or become entitled to receive any benefit by reason of a contract made by the Club with him or with a firm of which he is a member or with a company in which he has substantial financial interest.

This Report is made in accordance with a resolution of the Executive Council dated 28th day of March 1985.

Wendy Clark President
Noel Disken Treasurer

FIELD NATURALISTS CLUB OF VICTORIA
GENERAL ACCOUNT
STATEMENT OF INCOME & EXPENDITURE YEAR ENDED 31 12 1984

INCOME

1983 $		$	$
	Subscriptions Received —		
216	Arrears	215	
12,031	Current	13,511	
585	Supporting	464	
12,832			14,190
186	Sales of "Victorian Naturalist"		685
	Interest Received —		
15	Library Fund	15	
67	Bank Account	81	
1,475	Commonwealth Bonds	1,475	
767	Bonds — M Wright Legacy	767	
147	Bonds — C M Walker Legacy	147	
1,040	National Mutual Deposit	603	
70	Life Membership Fund	106	
208	Natural History Medallion Fund	316	
3,789			3,510
4	Sundry Income	2	
233	Profit on Book Sales	1,973	
237			1,975
	Deficit for year		678
16,847			16,847

EXPENDITURE

1983 $			$	$
	Victorian Naturalist			
12,781	Printing		13,132	
767	Illustrating		1,313	
1,961	Despatching		2,160	
19	Editorial		—	
			16,605	
15,528				
	Less — Grants			
—	Ingram Trust	—		
3,200	Treasury (Note 3)	3,000	3,000	
12,328				13,605
	Working Expenses —			
402	Postage & Telephone		354	
372	Printing & Stationery		311	
1,041	Bookkeeping & Typing		1,012	
790	Rent — Herbarium		895	
254	Affiliation Fees, Subscriptions & Donations		209	
165	Auditor's Remuneration (Note 1)		180	
161	Insurance		264	
298	General Expenses		373	
340	Natural History Medallion Expenses		677	
180	Kinglake Expenses — Rates		250	
4,003				4,525
	East Gippsland Survey		87	
	Less Recouped from Treasury Grant		(87)	—
16,331				18,130

17,044	21,038	—	Nature Show	806
		—	Author's Reprints	142
		443	Subject Index — (Profit)	(13)
			Club Improvement Account —	
		233	Transfer of Profit on Book Sales	1,973
		37	Surplus for year	—
		17,044		21,038

1. Auditor's Remuneration of $180 relates to auditing services only. No other benefits were received by the Auditors in respect of their services to the Club.
2. No Emoluments were paid by the Club to any member of the Executive Council.
3. State Treasury Grants for 1983/84 and 1984/85 have been received, but grants totalling $2,513 had not yet been applied against expenditure at 31/12/1984.
4. Basis of Accounting. The accounts have been prepared under the historical cost convention and have not been adjusted to take into account the current cost of specific assets.

FIELD NATURALISTS CLUB OF VICTORIA
BALANCE SHEET AS AT 31 DECEMBER, 1984

LIABILITIES

1983			
	Current Liabilities		
$3,564	Subscriptions paid in advance	$1,500	
3,367	Sundry Creditors	314	
154	M A Ingram Trust Grant in hand	154	
2,600	Treasury Grants in hand (Note 3)	2,513	
9,685			$4,481
	Special Funds & Accounts		
8,504	Building Fund	9,668	
49,179	Publication Fund	56,141	
11,660	Excursion Fund	13,590	
6,000	Marie Allender Excursion Fund	6,000	
100	Library Fund	100	
7,789	Club Improvement Account	9,296	
5,217	Estate M Wright Legacy	5,217	
1,466	Estate C M Walker Legacy	1,466	
20	Estate R S Chisholm	20	
200	Estate I F Knox Legacy	200	
200	Estate Ivy Dixon	200	
204	Estate I Hanks	204	
820	Wilfred C Woolard Fund	888	
881	D E McInnes Fund	934	
483	V H & B E Miller Fund	416	
90	N A Wakefield Memorial Fund	90	
300	P F Morris Gift Account	300	
250	Cedric Ralph Gift Account	250	
500	P Matches Memorial Fund	500	
356	Kinglake Project Fund	398	
2,014	Natural History Medallion Fund	2,648	
520	Life Membership Fund	520	
96,654			109,046

ASSETS

1983			
	Current Assets		
$4,053	Cash at Bank	$1,497	
10,000	Australian Savings Bonds at Cost	10,000	
1,541	Sundry Debtors	2,256	
	Stocks on Hand at cost —		
201	Badges & Sundries	122	
298	Books for Sale	1,377	
1,015	Victorian Naturalist Subject Index	970	
17,018			16,222
	Fixed Assets at cost		
9,388	Library Furniture & Equipment	9,854	
141	Land — Cosstick Reserve, Maryborough	141	
—	— Harold C Frahm, Kinglake	—	
9,529			9,995
	Investment of Funds at cost		
8,300	Australian Savings Bonds	8,300	
7,500	Esanda Ltd Debentures	8,300	
	National Mutual Permanent		
6,999	Building Society — Deposit	3,548	
353	Statewide Building Society — Deposit	344	
23,152			20,492
	Building Fund		
3,100	Australian Savings Bonds at cost	3,100	
5,000	Esanda Ltd Debentures at cost	5,600	
28	Sundry Debtors	—	
376	Cash at Bank	986	
—	Less Sundry Creditors	(18)	
8,504			9,668

	Surplus Account				**Publications Fund**		
12,482	Balance at 1/1/1984	12,793		45,380	Australian Savings Bonds at cost	45,380	
274	Transfer from Club Improvement Fund	466		—	Esanda Ltd — Debentures at cost	2,500	
37	Surplus (Deficit) for year	(678)		9,068	Book Stocks at cost	7,215	
12,793			12,581	600	Sundry Debtors	—	
				2,910	Cash at Bank	3,227	
				(8,779)	Less Sundry Creditors	(2,181)	
				49,179			56,141
119,132			126,108				
				1,000	**Excursion Fund** Australian Savings Bonds at cost	1,000	
				6,990	Nat. Mutual Perm. Bldg. Soc. — Deposit	7,646	
				4,236	Cash at Bank	9,667	
				(566)	Less Sundry Creditors	(4,723)	
				11,660			13,590
				119,132			126,108

FIELD NATURALISTS CLUB OF VICTORIA
BUILDING FUND

Balance of Fund at 31 December 1983	$8,504
Interest on Investments and Bank Account	1,164
Balance of Fund at 31 December 1984	9,668

PUBLICATIONS FUND

Balance of Fund at 31 December 1983		$49,179
Interest on Investments and bank Account		6,702
Surplus for the year from —		
Fossil Book	$212	
Ferns of Victoria and Tasmania	36	
Wild Flowers of Wilsons Promontory National Park — Royalties	11	
Birds of Dandenongs	1	260
Balance of Fund at 31 December 1984		$56,141

CLUB IMPROVEMENT ACCOUNT

Balance of Account at 31 December 1983	$7,789
Book Sales Account Profit	1,973
	$9,762
Less — Purchase of Library Books & Equipment transferred to Surplus Account	466
Balance of Account at 31 December 1984	$9,296

EXCURSION FUND

Balance of Fund at 31 December 1983	$11,660
Interest on Investments and Bank Account	1,766
Donations	25
Surplus on Tours	139
Balance of Fund at 31 December 1984	$13,590

Field Naturalists Club of Victoria
Statement by the Members of the Executive Council

In the opinion of the members of the Executive Council of the FIELD NATURALISTS CLUB OF VICTORIA, the accompanying Balance Sheet is drawn up so as to give a true and fair view of the state of affairs of the Club as at 31 December 1984, and the accompanying Statement of Income and Expenditure is drawn up so as to give a true and fair view of the financial results of the Club for the year ended 31 December 1984. There are reasonable grounds to believe that the Club will be able to pay its debts as and when they fall due.

SIGNED in accordance with a resolution of the Executive Council on 28 March 1985.

Wendy Clark, President
Noel Disken, Treasurer

Auditor's Report to the Members of
Field Naturalists Club of Victoria

We report that we have audited the accounts of the FIELD NATURALISTS CLUB OF VICTORIA in accordance with Australian Auditing Standards.

In our opinion:—

(a) The accompanying accounts, being the Balance Sheet, Statement of Income and Expenditure and Notes to Accounts, together with the Statement by Members of the Executive Council, are properly drawn up in accordance with the provisions of the Companies (Victoria) Code 1981 and so as to give a true and fair view of:—

(i) The state of affairs of the company at 31 December 1984 and of the results of the company for the year ended on that date; and

(ii) the other matters required by Section 269 of that Code to be dealt with in the accounts;

and are in accordance with Australian Accounting Standards.

(b) The accounting records and other records, and the registers required by that Code to be kept by the company have been properly kept in accordance with the provisions of that Code.

DANBY BLAND PROVAN & CO.
Chartered Accountants
R. M. Bland
Partner

Melbourne
29th March 1985

FIELD NATURALISTS CLUB OF VICTORIA

Reports of recent activities

General Meeting
Monday, 11th February

The Speaker for the evening was Dr. Brian Smith, Senior Curator of Zoology at the Museum of Victoria, who spoke on "The Radulae of Non-marine Molluscs".

The phylum Mollusca is the second largest phylum of the animal kingdom, being exceeded in the number of species only by the Arthropoda. There are six classes within the phylum and it is only the class Bivalvia from which the radula is entirely absent, although it may be reduced in members of other classes.

The radula is a wide, flat, ribbon-like structure formed of chitin which bears a number of transverse rows of teeth. Each row of teeth is identical to the last, but teeth differ from each other across a row. Rows of teeth are secreted by the radular gland at the base of the radula.

The radula covers a broad tongue-like organ called the adontophore which is drawn in and out during feeding, so rasping up particles of food and carrying them back to the oesophagus. Teeth may wear very quickly and can be replaced at the rate of 2½ rows per day in some species.

The shape of the teeth and their arrangement on the radula is usually peculiar to a species and is, therefore, a very important taxonomic feature of molluscs. The structure of the radula exhibits considerable variation depending on the diet of a particular species.

Dr. Smith showed many interesting slides including scanning electron micrographs to demonstrate the variation in radular structure between species. He also detailed the preparation of slides of mounted radulae for examination under the light microscope.

Exhibits:

Displayed for viewing were:—

— Cones of *Banksia serrata* and *Pinus radiata* attacked by Yellow-tailed Black Cockatoos at Yanakie, South Gippsland.

— Also from Yanakie were specimens of *Eucalyptus crenulata, Acacia sophorae* and *Mus musculus.*

— Fruits of *Cassia helmsii* (probably) from North-west N.S.W.

— A giant stick insect from the Ballarat F.N.C.

— Excerpts from old *Victorian Naturalists* including lists of members and programmes of meetings and excursions around the turn of the century.

— Hydroids, Foraminiferans and seaweeds from Black Rock, including the hydroid *Aglaophenia plumosa* on a green seaweed and three species of the brown seaweed *Cystophora.*

— The nest of a mud-dauber wasp.

Nature Notes:

— Report on the recent increase in illegal smuggling of Frill-necked Lizards from Australia to Japan following the recent popularity of the lizard in Japan due to television advertising.

— Large numbers of dogwinkles are reported to have been illegally taken from the rocks at Mt. Martha by Chinese people. Discussion of the legislation to protect shellfish followed.

— A Nankeen Night-Heron with two young was seen by a pond opposite the Arts Centre in St. Kilda Rd..

General Meeting
Monday, 18th March

The Basin Junior Field Naturalists Club was elected as an affiliated club.

The Speaker was Dr. Tom Rich, Curator of Vertebrate Palaeontology at the Museum of Victoria, who spoke on "Australian Mammalian History".

The major tasks for palaeontologists studying the history of mammals on this continent are:—
1) determining chronology (what lived when). Dr. Rich pointed out that our knowledge of the Australian fossil mammalian fauna is now at a similar stage to that of the European fauna about 1850.
2) interpretation of the fossils to relate them to other known species and work out their origins and evolution.

Australia has a very poor mammalian fossil record due to several factors including a paucity of areas, such as deep valleys, favourable to the accumulation of fossils and the fact that our soils are so weathered and fossils tend not to be preserved in them. No marsupial fossils have been found in Australia older than about 20 million years. Dr. Rich outlined how Australia was once attached to the other southern continents and how between 80 and 100 million years ago, it began to drift northward as the continents split up. During this period Australia was isolated from invasion by land mammals and the marsupials were able to radiate and diversify. It is only in the last 10 million years that we have been close enough to the northern land masses for terrestrial mammals to have invaded from them.

Dr. Rich described a number of the better fossil locations in the country and the specimens they have yielded. One of the most exciting discoveries in many years was made at Lightning Ridge late last year. A piece of opalized jaw, probably about 112 million years old, from the Lower Cretaceous, was found by prospectors. Examination of the teeth showed them to be almost identical to fossil platypuses except for their root structure, and very similar to the ancient marsupial line. This may have important implications for determining the phylogeny of these groups.

The speaker then told us the current state of knowledge regarding the ancestry and relationships between the various groups of marsupials, much of which is still uncertain because of the poor fossil record. He also spoke briefly on what is known of the history of bats and rodents on this continent.

Members were asked to stand and observe a minutes silence in memory of Mr. Ken J. Simpfendorfer who died recently. Mr Simpfendorfer had been a member of the club for 40 years and was awarded his honorary membership last December.

Exhibits:—
— under the microscopes was pollen of the Yam Daisy and the Tiger Lily which was a beautiful pink.
— two species of introduced wasps: the German (European) Wasp, *Vespula germanica* and the English Wasp, *V. vulgaris* and a similar native wasp which could be confused with them.
— two common species of mistletoe, the Creeping Mistletoe *(Muellerina eucalyptoides)* and Box Mistletoe *(Amyema miquelii)* and 2 species of azure butterflies, one species being restricted to each species of mistletoe. The larvae feed on the mistletoe at night and shelter under the bark of the host tree by day.
— ferns offered for sale in aid of Kinglake property.
— rock samples from South Morang. A granite (granodiorite) mass intruded into mudstone strata of the Silurian period and the heat of the granite altered the sedimentary rocks in contact with the granite mass. The intrusion occurred about 350 million years ago.

Nature Notes:
— a report from "The Age" about whistling moths. There are two species common in these parts. Their wings are unusually small relative to their body size and they vibrate them against knobs on their heads to produce noise.
— another Nankeen Night Heron reported in an ornamental pond opposite the Art Gallery in St. Kilda Road.

The Victorian Naturalist invites contributions of original papers relating to Australian natural history, particularly of Victoria. All papers are assessed by an independent referee before publication.

Short contributions of natural history observations are also invited for use as "Naturalist Notes". These contributions may be edited, or excerpts published, at the Editors' discretion. Such notes are not normally refereed, and may be submitted more informally.

All contributions are to be written in concise, simple English.

For cost reasons, authors of original papers submitted for publication are requested to conform with the following guidelines. Any author who has difficulty in complying with these guidelines, or has queries concerning manuscripts, should consult the Editors before submitting a manuscript.

Submission of Manuscripts

Manuscripts should be sent to J. U. Phillips, C/O Museum of Victoria (Division of Natural History and Anthropology), 285 Russell Street, Melbourne, 3000.

Two typewritten copies of the manuscript should be submitted. Authors are advised to retain a further copy.

Format

Text should be fully revised, typed double spaced on one side of the paper only, with a wide margin, pages numbered consecutively, and should conform in style to recent issues of the *Victorian Nat.*

Author's name and address or institution should appear beneath the title. Underline only those words to be italicised in the text i.e. genus and species names, and titles of periodicals and books. All measurements should be expressed in the metric system (SI units).

References should be cited in the text as Brown (1981) or (Brown, 1981). Footnotes must be avoided. Acknowledgements should be grouped at the end of the paper before References.

References should be listed alphabetically by author's surname at the end of the paper. All references should be cited in the text. Abbreviations of titles of periodicals should conform with those in *A World List of Scientific Periodicals* (4th ed., Butterworth). Refer to recent issues of the *Victorian Nat.* for the formatting of references.

Tables and Figures

Tables should only be used for essential data needed to show important points in the text. They should be numbered consecutively, referred to in order in the text, and designed to fit within the print area of 115 x 180 mm. Each table must have an explanatory caption.

Figures may be in the form of drawings or photographs. They should be identified on the back with the author's name and the figure number. The top should be indicated and the magnification by scale where appropriate. Compass directions must be indicated where necessary. All figures should be referred to in the text and numbered consecutively (Fig. 1, Fig. 2 etc.)

Figures should be carefully prepared and should be submitted ready for publication. Each should have a short caption. Maximum size is 115 x 180 mm; single column width is 55 mm. Figures are preferably submitted at actual size. Lettering on Figures should be done by the author; care is needed to ensure that all letters are legible after reduction

Line drawings should be made in black ink

Photographs should only be used where essential due to the high cost of printing plates. They should preferably be unmounted, glossy black & white prints, showing good detail and moderate contrast.

Proof and Reprints

Galley proofs will be sent to the author, who should correct and return them as soon as possible. Only the minimum of essential corrections should be made.

The reprint service is currently under review. Please direct enquiries to Russell Thomson, Department of Microbiology, La Trobe University, Bundoora, 3083

Taxonomic Papers

Papers describing new taxa will not be accepted for publication unless the primary type material is deposited in a recognised public museum or herbarium.

It is suggested that in other more general papers where taxonomy is discussed, voucher material be lodged in a public collection, and the repository details cited in the text.

Field Naturalists Club of Victoria

In which is incorporated the Microscopical Society of Victoria

Established 1880

Registered Office: FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

OBJECTS: To stimulate interest in natural history and to preserve and protect Australian fauna and flora.
Members include beginners as well as experienced naturalists.

Patron:
His Excellency Rear Admiral SIR BRIAN S. MURRAY, KCMG, AO.

Key Office-Bearers 1984-1985

President
Miss WENDY CLARK, 27 Rangeview Grove, North Balwyn, 3104 (859 8091 A.H.)

Vice-President: Dr. BRIAN SMITH, c/- Museum of Victoria, Russell St., Melbourne, 3000

Hon. Secretary: Mr. I. FAITHFULL, 83 Easey Street, Collingwood, 3066 (419 9908 A.H.)

Hon. Assistant Secretary: Mr. A THIES, 25 Davies Street, East Malvern, 3145 (25 6012)

Hon. Treasurer: Mr. NOEL DISKEN, 24 Mayston St., Hawthorn East, 3123 (82 3471 A.H.)

Subscription-Secretary: Mr. D. BEVAN, 33 Chaucer Crescent, Canterbury, 3126 (836 3044)

Editorial Material: Forward to Ms J. U. PHILLIPS, C/- Museum of Victoria, Russell St., Melbourne, 3000.

Librarian:

Excursion Secretary: Miss MARIE ALLENDER, 19 Hawthorn Avenue, Caulfield, 3161 (527 2749)

Sales Officer (Books): Mrs H.STANFORD, 100 Middlesex Road, Surrey Hills, 3127 (830 1505)

Sales Officer (Victorian Naturalist only): Mr D. F. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Group Secretaries

Botany: Mr PETER CARWARDINE, 2a Victoria Road, Malvern, 3144 (509 0622 B.H. 211 8958 A.H.)

Day Group: Mr D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427).

Geology: Miss HELEN BARTOSZEWICZ, 16 Euroa Avenue, Nth. Sunshine, 3020. (376 1706 A.H.)

Mammal Survey: Mr LANCE WILLIAMS, 29 Erica Crescent, Heathmont, 3135 (879 1962 A.H.)

Microscopical: Mrs ELSIE GRAHAM, 147 Broadway, Reservoir, 3073 (469 2509)

MEMBERSHIP

Membership of the F.N.C.V. is open to any person interested in natural history. The *Victorian Naturalist* is distributed free to all members, the club's reference and lending library is available and other activities are indicated in reports set out in the several preceding pages of this magazine.

Subscription rates for 1984.

Metropolitan Members (03 area code)	$18.00
Joint Metropolitan Members	$21.00
Country/Interstate/Retired Members	$16.00
Joint Country/Interstate/Retired Members	$18.00
Student (full-time)	$12.00
Junior (under 18; no Victorian Naturalist)	$3.00
Subscription to Victorian Naturalist	$16.00
Overseas Subscription to Victorian Naturalist	$22.00
Individual Journals	$2.50

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The Victorian Naturalist

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GENERAL MEETINGS

Monday, 17th June, 8.00 p.m.

Peter Jackson. "Native Freshwater Fishes of Victoria". Honorary membership will be awarded to Mr. Brian Williams, Mr. G. G. Shepherd, and Mr. Neil V. Burrows.

Monday, 8th July, 8.00 p.m.

Dr. Malcolm Calder. "Reproductive biology of Orchids". Honorary membership will be awarded to Miss J. M. Forster.

Monday, 12th August, 8.00 p.m.

To be announced.

Honorary membership will be awarded to Miss Laura White.

New Members — March/April General Meetings

Metropolitan

Mr. M. Burston, Sweeneys Lane, Eltham, 3095.
Mr. D. J. Mahler, 7 Westwood Drive, Bulleen, 3105.
Mr. Ern Mainka, Flat 2/383 Toorak Road, South Yarra, 3141
Mr. Jamie Lawson, 16 Birdwood Street, Reservoir, 3073.
Mr. Bruce McGinness, 35 Myrtle Grove, Altona, 3018

Country

Mrs. M. Cameron, 4 Connor Street, East Geelong, 3219.
Ms. Isabel Crawford, Rotamah Island Bird Observatory, P.O. Box 75, Paynesville, 3880.

Joint Metropolitan

Mr. Craig & Mrs. Colleen Hildebrand, 17 Langtree Avenue, Pascoe Vale South, 3044.

Student

Mr. Peter Balmford, 459 The Boulevard, East Ivanhoe, 3079.

FNCV EXCURSIONS

Queens Birthday weekend, 8th-10th June. Campout at Creswick led by John Milligan and Dr. Jim Willis. Details from J. Milligan 386 4305.

Sunday, 7th July. Ripponlea. Meet at Ripponlea at 11.30 a.m. Bring lunch. We may go on to the beach early in the afternoon if the weather is suitable.

Sunday, 4th August. Point Cook Metropolitan Park. The coach will leave Batman Avenue at 9.30 a.m., fare $8.00. Bring lunch. If the weather is bad we will go on to Werribee Park afterwards.

Friday, 9th-Thursday, 22nd August. Rainbow Beach, Fraser Island, Noosa Heads. This excursion will start from Brisbane to allow members the choice of transport from Melbourne and the opportunity to extend their stay if they wish. A coach will leave Brisbane at 9.30 a.m. Friday, 9th August for Rainbow Beach where the party will stay at Gazebo Gardens D.B.B. On Saturday they will depart for a six day visit to Fraser Island with full board and daily tours to various parts of the island, which is not just sand dunes. It is quite large and contains lakes, rainforest, interesting vegetation as well as coloured sands, etc. Saturday 17th, we return to the mainland, overnight at Rainbow Beach then on to Noosa Heads on Sunday 18th, where we stay at Terrace Gardens R.O. until Thursday, 22nd August, when the excursion concludes at Noosa Heads as some may wish to stay longer or go futher north. There is a regular bus service running several times a day to Brisbane so it is possible to catch a plane in the afternoon. The approximate cost from Brisbane to the conclusion at Noosa Head is $650.00 There may be a slight variation if numbers are less than expected, and a supplement for single rooms. All bookings are for twin share. The full cost should be paid by June 28th. The Queensland Government Travel Centre is holding some Apex air tickets in case members want them but they should be obtained as soon as possible.

Saturday, 31st August to Friday, 6th September. Rotamah Island Bird Observatory. See last Naturalist (March/April 1985) or contact Excursion Secretary for details.

Sunday, 1st September. Winneke Dam. The coach will leave Batman Avenue at 9.30 a.m., fare $8.00. Bring a picnic lunch.

Saturday, 21st September. Day walk in Stony Creek area near Clonbinane. Leader: J. Milligan.

Saturday, Sunday, 5th-6th October. Maryborough. Combined V.F.N.C.A. Spring weekend. This is a wonderful area in October so please put this weekend in your diaries and look for details in the next Naturalist.

Sunday, 12th to Sunday, 19th January, 1986. Hobart. Details later.

GROUP MEETINGS

FNCV members and visitors are invited to attend any Group Meetings.

Day Group — Third Thursday

Thursday, 20th June. Coburg Lake and Merri Creek walk. Meet at Batman Station 11.30 a.m. Catch Gowrie train at Flinders St. Leader: Andy Blackburn 379 8960.

Thursday, 18th July. State Theatre and Art Gallery Meet in foyer of Concert Hall (cnr. Princes Bridge) at 10.30 a.m. (note time). Tour $1.50. Leader: Betty Gillespie 578 1879.

Thursday, 15th August. Westerfolds Park (MMBW). Catch 10.34 a.m. Bus No. 279 (Templestowe & Newmans Rds.) at the corner of Flinders & Russell Streets. Alight at cnr. of Porter & Williamson Sts. Leader: Jim Lawson 470 2271.

(Continued inside back cover)

The Victorian Naturalist

Volume 102 Number 3

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Cover Illustration: Female Swallow-tail Butterfly, *Papilio fuscus.*

An Assessment of a Rainforest Regeneration Program at Wingham Brush, New South Wales

By J. Stockard, B. Nicholson[2] and G. Williams[3]

Abstract

A current regeneration program in an alluvial rainforest remnant at Wingham, (mid-north coast area N.S.W.), is discussed. The damaging effect of three exotic vine species on the native canopy is explained and these vines, *Macfadyena unguis-cati* (L.) A. Gentry (Bignoniaceae), *Anredera cordifolia* (Ten.) Steenis (Basellaceae) and *Cardiospermum halicacabum* L. (Sapindaceae), are viewed as important contributors to the decline of the remnant rainforest at Wingham. The effects of introduced *Tradescantia albiflora* Kunth (Commelinaceae) on the regeneration of the Wingham rainforest are also considered. Manual and chemical weed control strategies used on the above exotic plants are discussed in relation to the regeneration program. In addition, a number of general rainforest regeneration principles are considered, with particular emphasis on the importance of light availability and canopy health.

Introduction

"Wingham Brush" is a heavily disturbed and weed-infested alluvial rainforest remnant of 8 hectares adjoining the New South Wales mid-north coast town of Wingham (Fig. 1). "Wingham Brush" is a small relic of the once extensive rainforests of the Manning River floodplain and represents approximately 10% of the remaining alluvial subtropical rainforests in New South Wales. Coocumbac Island Nature Reserve, at Taree, preserves the only other example of alluvial rainforest now occurring in the Manning floodplain.

1. Lots 11-12 Combined St., Wingham, N.S.W. 2429.
2. "Yaypo Rise", The Bight, Wingham, N.S.W. 2429.
3. Lorien Wildlife Refuge, Lansdowne, N.S.W. 2430.

The rainforest association at this site, however, is considerably less diverse than "Wingham Brush"and is not a duplication of that at Wingham.

Due to its location within the township boundaries and its immediate proximity to a riverbank recreation area, "Wingham Brush" has suffered considerable physical disturbance from both residents and tourists. In the past, access was not restricted and a proliferation of minor pedestrian and bicycle tracks left little of the rainforest undisturbed. "Wingham Brush" also has a history of logging for commercial timbers and was most recently logged in 1941. A significant proportion of the canopy is constituted by senescent trees and tree collapse is common, further compounding the disturbance. The replacement of native species with exotic plantings, as practised in the past, has additionally degraded the scientific value of this rainforest.

Since 1980, a regeneration program at "Wingham Brush" has continued under the auspices of the National Trust (N.S.W.), with funds provided by the Greater Taree City Council. A regeneration team comprising 6 people, each of whom works 4 hours per week, weather permitting, has undertaken systematic weed eradication in the rainforest. To date, some 50% of "Wingham Brush" has received weed attention to varying degrees. As part of the regeneration program, horses, bicycles and motor bikes have been prohibited in "Wingham Brush". As well, one vehicle track which dissected the rainforest has been closed. The establishment of a timber-fenced walkway has been partially completed and has helped considerably in confining access.

In the absence of any contiguous vegetation, "Wingham Brush" is a vegetational island and its location in Wingham

Fig. 1. View of the eastern section of Wingham township. Arrows show extent of "Wingham Brush" and proximity to township.

township has given it a relic urban aspect, in much the same sense as Glebe Gully in Sydney's eastern suburbs. Management problems are considerable if the site is to maintain any significant nature conservation and biogeographic values. Progress, as described above, has been made in confining access. The rainforest is bisected by a major unsealed roadway which is still heavily used. The closure of this road will be beneficial in reducing the high ratio of perimeter length to rainforest area and will further assist in confining access.

The exotic vine species *Macfadyena unguis-cati* (L.) A. Gentry "Cat's Claw" (Bignoniaceae), *Anredera cordifolia* (Ten.) Steenis "Madeira Vine" (Basellaceae), and *Cardiospermum halicacabum* (L.) "Balloon Vine" (Sapindaceae), are major contributors to site degradation. The ability of *Macfadyena, Anredera* and *Cardiospermum* to occupy and dominate the canopy has led to significant crown disturbance and individual tree mortality. Of lesser significance, *Tradescantia albiflora* Kunth "Wandering Jew" (Commelinaceae) occupies the forest floor and impedes seedling emergence. The control of these exotic species is discussed. A number of management problems at "Wingham Brush" have been discussed previously by Stockard (1983).

There are no large native mammals remaining in the rainforest and, to date, no survey of the terrestrial small mammal fauna has been undertaken, G. Hoye (pers. comm.) has recorded 7 species of insectivorous bats in addition to the Little Red and Grey-headed fruit bats. These fruit bats seasonally roost in very large numbers within the rainforest, and, during these times, some canopy damage is attributable to them. However, the fruit bats' roles as pollinators in a wide range of vegetation communities and as seed distributors of various rainforest plants are only now being documented (A. McWilliam pers. comm.).

The rainforest at Wingham is an important local refugium for birds, with 78 recorded species (G. Coleman pers. comm.), 10 of which are either rainforest restricted or largely rainforest dependent during their nesting or feeding activity.

Discussion

Rainforests differ from other major plant communities in that they possess a relatively tall, closed canopy structure and a seasonally stable soil moisture regime.

Disturbance to the canopy in small rainforests may result in soil dessication with an adverse impact on seedling establishment of some climax species. Secondary species may thereby be advantaged, thus altering, at least in the short term, the species composition of the forest. Soil dessication may be an important consideration in the establishment and viability of even relatively large reserves (Myers, 1979). Thus the establishment of a healthy, closed canopy is a major priority in the regeneration methods used.

In conjuction with the initiation of the regeneration work at "Wingham Brush", an evaluation of the species composition of the site was undertaken. This gave a basic species inventory which also provided a means of gauging and monitoring the impact of regeneration activities on the site flora. A preliminary list of tree species is given in Appendix 1.

The man hours required to manually control large expanses of weeds are considerable (Anon, 1982) and recourse to weedicide treatment has been recommended in some situations during rainforest regeneration programs (Nicholson, 1981; Clark, 1982). In the absence of weedicide application some manual control programs may be overwhelmed by weed vigour (Anon, 1983). Manual removal of *Macfadyena unguis-cati* was found to be unfeasible in 1980 and chemical means were therefore investigated.

The glyphosate herbicide Roundup® (Monsanto Co. U.S.A.) was chosen for the regeneration program at "Wingham Brush" due to its translocative mode of action, lack of bioaccumulation, low toxicity and relatively rapid degradation in soil and water, breaking down into naturally occurring amino acids.

A systematic approach to the removal of *Macfadyena, Anredera, Cardiospermum* and, also, *Tradescantia* has been formulated which, generally, proceeds in stages from core areas to edge areas and from canopy attention to forest floor attention. The factors which influence the stages of weed removal are discussed under the headings forest canopy, forest margin, and forest floor.

Forest Canopy

Macfadyena unguis-cati is a very aggressive exotic vine, endemic to South America (Beadle *et al.*, 1976), and notable for its capacity to grow well in restricted light conditions. Originally cultivated for its profusion of large, ornamental yellow flowers, its escape from cultivation has had a serious consequence in the rainforest at Wingham. Reproduction of *M. unguis-cati* occurs through vegetative means from subterranean tubers as well as from seed. Although seed production in *M. unguis-cati* is prolific, seeds are short lived. *Macfadyena* vines wander across the forest floor producing tubers approximately every 0.5 m. These tubers become sites of advancement, producing vine growth which then behaves in a like manner. In this way, *Macfadyena* carpets the forest floor. Flood deposited silt has compounded the problem by covering layers of tubers which remain viable and active. *M. unguis-cati* then occupies the newly deposited surface area, resulting in a layering of infestation.

Macfadyena unguis-cati is an aggressive destroyer of canopy, climbing quickly to the top of individual host trees. Upon gaining the bright light of the canopy top, its vegetative proliferation from tubers at ground level is rapid, with each tuber extending vine growth up into the tree. In this manner *M. unguis-cati* vines commonly cover tree trunks with their individual stems to the extent that the tree bark is largely obscured. Thus, through light restriction, sheer weight of vine mass, and root competition, tree crowns are increasingly damaged by this vine. Individual trees are thereby killed and reduced to vine-enclosed poles which eventually topple to the ground.

Macfadyena vines are cut twice with secateurs or loppers (Fig. 2) approximately 1.5 m from the ground firstly, and this cut vine stump is pulled away from the trunk

of its host tree prior to a second cut being made, to avoid herbicide contacting the tree's bark. The second cut is then made about 30 cm. below the first. The application of "Roundup" 100% is applied with a small paintbrush to this second cut surface **immediately** after sectioning. Even small delays of less than a minute will compromise herbicide effectiveness, as the cambium will speedily seal itself on contact with the atmosphere. Vines less than 1 cm. in diameter are stripped on one side with a knife or secateur edge to further expose cambium and this provides an additional area for herbicide uptake. Due to the vast underground network of tubers, translocation of herbicide may not reach the peripheral limits and therefore some regrowth often results.

Making two cuts allows released trees to be readily spotted and regrowth to be easily identified. Any regrowth of *Macfadyena unguis-cati* is allowed to extend 1-2 m. before being pulled down by hand, coiled on the ground away from any native plants and then misted with "Roundup" 1:5. Any subsequent regrowth is treated in the same manner. This technique is proving extremely effective against *M. unguis-cati* at "Wingham Brush".

Anredera cordifolia also is a very aggressive exotic vine introduced from South America (Beadle *et al.*, 1976) and is the most serious problem at "Wingham Brush" (Fig. 3). Reproduction in Australia is through vegetative means from tubers which occur prolifically on stem and root growth. Although *Anredera* flowers profusely during Autumn, seeds are not formed in Australia. In addition, *Anredera* is an extremely difficult plant to control, being resistant to 2, 4-D and 2, 4, 5-T (Kleinschmidt and Johnson, 1977). Shading, however, suppresses *A. cordifolia* growth. Light-suppressed tuberlings commonly occur at densities of 1500 tuberlings per sq. m. below infested canopies at "Wingham Brush".

A. cordifolia exudes a heavy, viscous sap when cut and this provides a barrier

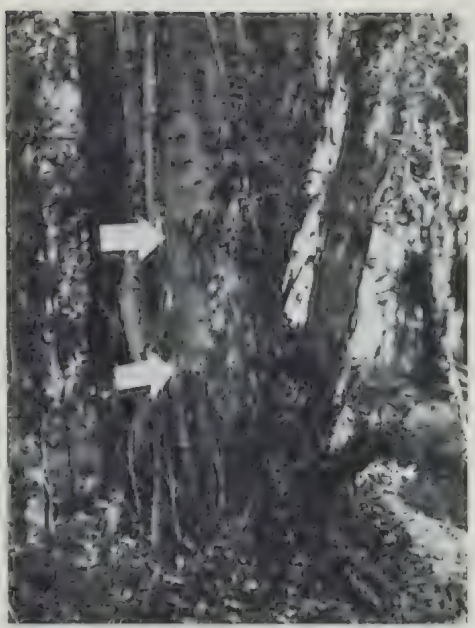

Fig. 2. *Macfadyena* vines after treatment.

to the uptake of herbicide when using the cut and paint technique. Vines exceeding 5 cm. in diameter are treated by carefully scraping the cut base with a knife to expose cambium right around the stump and approximately 20 cm. along the stem like a half-peeled potato. This area, painted with "Roundup" 100%, allows herbicide uptake.

Smaller vines are cut and the basal sections are laid on the ground away from native plants. Smaller trees and shrubs are manually released from *Anredera* growth. After vine release, deformed, downward extending branches are pruned to promote healthy growth. All *Anredera* tubers and stems within reach are bagged and removed from the site.

As the severed and treated *Anredera* vines begin to lose leaves, light increases at ground level and the formerly light-suppressed *A. cordifolia* tuberlings blanketing the ground begin to grow vigorously. This tuberling growth, and, as well, the vigorously reshooting severed vine stems, are sprayed 3-4 weeks after initial cutting.

Fig. 3. *Anredera* infestation.

Careful site preparation is required prior to spraying. All native plants are manually freed of *Anredera* regrowth and tuberling extension growth and this material is laid on the ground. Care is taken to isolate the *Anredera* from tree trunks and foliage of native plants. Smaller trees are manually weeded of *Anredera* growth within a radius of 20 cm. from the stem. Where ferns are present (e.g. *Adiantum formosum* R. Br. Adiantaceae) in sites thickly infested with *Anredera*, the fern fronds are clipped close to the ground to protect the fern as well as facilitate the spray operation. The application of sprayed "Roundup" 1:5 gives optimal control of *A. cordifolia.*

Initial cutting of *Anredera* often accelerates tuber production in the canopy and huge clusters of tubers frequently appear along the cut vine stems. Some clusters attain diameters of 30 cm. In humid or wet weather, tuber production generally is heavier and tubers are larger and better developed than those tubers produced during dry conditions. Aerial tubers survive for up to 2 years, during which time they continually drop to the ground. In addition, tubers buried under flood deposited silt and leaf litter sprout during favourable climatic conditions over this same time period. Therefore the spray control program needs to be retained over a period of at least two years after the initial treatment to avoid the *Anredera* regrowth (which can exceed 4 m. in as many weeks during warm, moist conditions) gaining access to native plant stems and foliage. Severe infestations of *A. cordifolia* at "Wingham Brush" require spray treatment every 4-6 weeks during the main growth period from October to April. Otherwise, a manpower-intensive program to remove this regrowth prior to spraying will occur.

it is necessary to carefully inspect for the presence of *Anredera* tuberlings at ground level before undertaking any vine clipping, as this may allow an increase in available light to these tuberlings. This caution particularly applies to curtains of vine growth along forest edge situations which, when cut, may allow penetration of light far into the forest.

Forest Margin

The rainforest margins are important for two main reasons. Firstly, edge situations are the site of potential expansion or contraction of the rainforest body. Secondly, the margin is important in restricting light and wind. Where *Macfadyena* and *Anredera* occur as edge vines, they are managed as described in the previous section. *Cardiospermum halicacabum* is an exotic tropical vine primarily restricted to edge situations at "Wingham Brush". Light exclusion inside the forest proper prevents *Cardiospermum* from penetrating into the forest. The southern edge of "Wingham Brush" was largely bound by this vine which formed a dense curtain. This curtain prevented canopy projection on the forest margin and caused growth deformation of individual trees. Tree

crowns were destroyed, thus causing retrogression of the forest edge.

Thick infestations of *Cardiospermum* are controlled by cutting the vine curtain at approximately 1.5 m. above ground level and pushing the basal growth away from the natives. When growth from these basal sections attains an additional 0.5 m., it is sprayed with "Roundup" 1:50. Although *Cardiospermum* produces large quantities of seed, seedlings are readily removed by hand pulling even if the vines are allowed to attain several metres in length. *Cardiospermum* has a small root system in relation to the area of its foliage and relatively large vines are readily removed manually.

Canopy projection occurs if vines are removed from site margins. The growth of isolated rainforest trees in the open results in trees with dense, rounded crowns. The trees on the edge of isolated remnant rainforests generally behave in this manner (Hockings, 1978). On open-edge situations, the canopy of rainforest will extend outwards and downwards to the ground. In the absence of light competition, the branches of edge trees shoot from low down on the trunk and the tree leans out, branches drooping down to extend outside the canopy to gain the light of the open. This results in an extended, convex, verandah-like edge. This edge growth performs the same protective function as the vine curtain, but, importantly, extends outwards several metres further when freed from vine growth (Fig. 4). This projection then creates conditions of micro-climate suitable for the further establishment of rainforest seedlings.

Forest Floor

As the canopy recovers and thickens after removal of exotic vines, light availability decreases at the forest floor. In these lower light levels few weeds appear able to persist. *Tradescantia albiflora,* a native of South America (Beadle *et al.,* 1976), is the primary exotic survivor in these conditions at "Wingham Brush"and, at optimum canopy development, covers the

Fig. 4. *Aphananthe philippinensis* exhibits canopy projection on eastern edge of Wingham Brush.

forest floor in a thin layer up to 6 cm. thick. In high light levels *Tradescantia* layers may exceed 1 m. in thickness and completely restrict all native seedling growth. This proliferated layer also deters unwanted weeds, particularly "Camphor Laurels", *Cinnamonum camphora* (L.) Nees (Lauraceae) and "Privets", *Ligustrum* sp. (Oleaceae). In addition, the *Tradescantia* layer aids in preventing surface soil dessication.

In areas of heavy canopy loss, *Tradescantia* dominates the forest floor and the removal of this impeding *Tradescantia* layer is necessary to allow seedling establishment. At "Wingham Brush", *Tradescantia* has been removed manually, placed in bags, and carried to a location within the "Brush" wherein it is composted. Given the vigorous, expansive nature of *Tradescantia* and the manpower restrictions at "Wingham Brush", manual removal may not always be considered preferable, particularly as regards cost efficiency. Experimental areas at "Wingham Brush" have demonstrated that *Tradescantia* infestations are successfully controlled by the application of sprayed "Roundup" 1:50. *Tradescantia* was manually removed in a radius of approximately 20 cm. from native plant stems prior to spray application. The time required for visible results of spray effectiveness on *Tradescantia* ranges from 6-8 weeks.

The removal of *Tradescantia* is not undertaken until the associated canopy is free of exotic vine growth for a period of at least 1 year. We consider that 2-3 years

of weed-free canopy growth is optimal as this allows the majority of weed seeds to germinate and perish under the *Tradescantia* cover. Canopy re-establishment before *Tradescantia* removal is also important to prevent excessive surface soil dessication.

After *Tradescantia* removal, native seedlings are identified and exotic seedlings are manually removed. In the more exposed areas, exotic species such as "Privets" and "Camphor Laurels" may comprise in excess of 60% of the total seedling regeneration. Seedling selection is undertaken manually when the seedling growth attains 10-15 cm. in height. At this size, in moist ground, exotics are readily pulled out. Soil structure is readily disturbed when wet and work is not undertaken after or during rain periods. As well, the use of knives and trowels as an aid to the removal of exotic seedlings is avoided to prevent damage to the surface roots of adjoining native seedling trees.

Once the regenerating seedlings reach a size which further shades the ground, follow-up weeding decreases as insufficient light exists for colonization by weed species. Decreased light levels may also restrict regeneration of some rainforest species dependant upon full light conditions (Floyd, 1977).

Rainforest seedlings are vulnerable to exposure and it has been observed that their incidence in edge situations is limited to within 3-4 m. of the rainforest margin. Assistance planting may be valuable in extending the area of natural regeneration (Nicholson, 1981, Clark, 1982), and has been used successfully at Victoria Park Nature Reserve in far northern New South Wales to extend the rainforest core area. A number of additional private projects on the north coast of New South Wales are utilizing plantings in this manner. Pioneer rainforest species, such as "Giant Stinging Trees", *Dendrocnide excelsa* (Wedd.) Chew (Urticaceae), are valuable and quick-growing at Wingham in this regard.

At Wingham, a 0.5m. radius of newspaper, 1-2 cm. thick, is placed around newly planted trees. The newspaper is positioned approximately 5 cm. away from the stem to avoid the development of collar rot. The newspaper is covered with woodchip, or other available mulching materials, to an approximate depth of 5 cm. to retain the newspaper in position. This practice provides a mechanical barrier to weed growth, retains surface moisture, and insulates the planted areas from ground temperature fluctuations.

Conclusion

Emphasis is placed on eliminating exotic vines from the rainforest canopy and restoring the canopy in these areas to its full, potential extent before attending to forest floor conditions. It is most important not to proceed to the final stage of regeneration, forest floor attention, unless the manpower is available to complete the task of exotic seedling removal. Otherwise, the native regeneration may be overwhelmed by emergent "Privets" and "Camphor Laurels", and other exotics, the establishment of which will then pose additional management problems.

Plantings are considered an integral part of accelerating the regeneration of open areas. However, where planting is undertaken in remnant rainforest rehabilitation projects, species used should be chosen from those naturally occurring at the site, and ideally propagated from material collected on site to maintain the gene base. Although species dominance may be altered in the maturing community by planting, the scientific integrity of the rainforest is maintained.

The need for a flexible approach to rainforest regeneration is stressed. Chemical application may be required where the extent of weed infestation, the vigour of infestating species, or manpower restrictions, make the use of purely manual techniques of weed control impractical. Indeed, a large, untrained manpower resource may result in excessive trampling and site disturbance.

The removal of every weed is sometimes not necessary. The restriction of light availability will often do much of the regeneration work for you. Weed colonization is more closely dependent on light availability than soil disturbance (Bradley, 1971), and species composition of regenerating rainforest is also dictated largely by light levels, with minimal canopy disturbance benefiting climax species maturation over early successional colonizers (Floyd, 1977). Williams (1984) found that weed establishment in a rainforest-wet sclerophyll association in mid-northern New South Wales appeared to be inhibited in less canopy-disturbed sites even when the forest floor was heavily disturbed. Smithers and Disney (1969) noted that regenerating rainforest remnants on Norfolk Island appeared to eliminate lantana canopies by shading and eventually reclaimed old lantana dominated rainforest sites.

Pioneer trees adjacent to the rainforest edge will, through their resultant shading and mulching, selectively determine the species composition below their canopies. Even in suburban gardens this effect is seen where planted trees and shrubs mulch and shade the ground. In such circumstances, *Dichondra*, *Oplismenus*, *Hydrocotyle*, *Commelina* and *Cyperus* are commonly found regenerating amongst lawns. Shading thus acts as a regenerating agent.

Acknowledgements

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Addendum

A 1:10 "Roundup" solution with surfactant is now recommended for spraying *Anredera* and *Macfadyena*. The addition of 3 ml. of surfactant to each litre of spray solution has allowed the effective concentration of glyphosate to be halved.

Preliminary trials in May, 1984, utilizing another herbicide technique on *Anredera* vines exceeding 5 cm. in diameter, have been successful. The vines were left unserved and a 20 cm. section of vine was carefully scraped right around to expose cambium, care being taken not to penetrate beyond the cambium layer. "Roundup" 100% was applied immediately to this exposed cambium. This technique has resulted in translocation of herbicide throughout the vine, thus eliminating the 2 year period of viable tuber fall which otherwise occurs after vine cutting. Visible deterioration of aerial tubers was not apparent before 6 months. Further testing with this technique has been undertaken and results require evaluation before the technique can be fully recommended.

Appendix 1

"Wingham Brush" tree list (A. G. Floyd 1976).
Endemic Species.

Ulmaceae	*Aphananthe philippinensis* Planch.
Moraceae	*Ficus coronata* Spin.
	Fiscus macrophylla Desf.
	Streblus brunonianus (Endl.) F. Muell.
Urticaceae	*Dendrocnide excelsa* (Wedd.) Chew
	Dendrocnide photinophylla (Wedd.) Chew
Monimiaceae	*Daphnandra micrantha* (Tul.) Benth
Lauraceae	*Beilschmiedia elliptica* White et Francis
	Cryptocarya meisnerana Frodin.
	Cryptocarya obovata R. Br.
	Neolitsea dealbata (R. Br.) Merr.
Capparidaceae	*Capparis arborea* (F. Muell.) Maid.
Pittosporaceae	*Hymenosporum flavum* (Hook.) F. Muell.
	Pittosporum undulatum Vent.
Mimosaceae	*Abarema sapindoides* (A. Cunn.) Kosterm.
Rutaceae	*Acronychia oblongifolia* (A. Cunn. ex Hook.) Endl. ex Heynh.
	Bauerella simplicifolia (Endl.) Hartley.
	Euodia micrococca F. Muell.
	Geijera latifolia Lindl.
Simaroubaceae	*Guilfoylia monostylis* (Benth.) F. Muell.
Meliaceae	*Dysoxylum rufum* (A. Rich.) Benth.
	Melia azedarach L. var *australasica* (A.Juss). C. DC.
	Toona australis (F. Muell.) Harms
Euphorbiaceae	*Baloghia lucida* Endl.
	Glochidion ferdinandi (J. Muell.) F.M. Bail.
	Mallotus philippensis (Lam.) J. Muell.
Celastraceae	*Elaeodendron australe* Vent.
Icacinaceae	*Pennantia cunninghamii* Miers
Sapindaceae	*Alectryon subcinereus* (A. Gray) Radlk.
	Alectryon tomentosus (F. Muell.) Radlk.
	Cupaniopsis parvifolia (F. M. Bail.) L. Johnson
	Diploglottis australis (G. Don) Radlk.
	Elattostachys nervosa (F. Muell.) Radlk.
	Guioa semiglauca (F. Muell.) Radlk.
	Rhysotoechia bifoliolata (F. Muell.) Radlk.
Rhamnaceae	*Alphitonia excelsa* (Fenzl.) Benth.
	Emmenosperma alphitonioides F. Muell.
Elaeocarpaceae	*Elaeocarpus obovatus* G. Don
Sterculiaceae	*Brachychiton acerifolium* (A. Cunn. ex Don) F. Muell.
	Heritiera actinophylla (F. M. Bail.) Kosterm.
Flacourtiaceae	*Scolopia braunii* (Klotsch) Sleumer.
Myrtaceae	*Backhousia sciadophora* F. Muell.
	Callistemon salignus (Sm.) DC.

	Eucalyptus grandis W. Hill ex Maiden
	Syzygium floribundum F. Muell.
	Syzygium paniculatum Gaertn.
Araliaceae	*Polyscias elegans* (C. Moore & F. Muell.) Harms
Alangiaceae	Alangium villosum (Bl.) Wangerin. ssp. *polyosmoides* (F. Muell.) Bloemb.
Sapotaceae	*Planchonella australis* (R. Br.) Pierre
Ebenaceae	*Diospyros pentamera* (Woolls & F. Muell). Woolls & F. Muell.
Ehretiaceae	*Ehretia acuminata* R. Br.
Verbenaceae	*Clerodendron tomentosum* R. Br.

Gould's Wattled Bat as a Food Item of the Lace Monitor

BY IAN MANSERGH† AND LINDA HUXLEY‡

The Lace Monitor or Tree Goanna (*Varanus varius*) is an arboreal, diurnal predator taking insects, reptiles, small mammals and carrion. Cogger (1979) notes it often forages on the ground yet is also a major predator of nestling birds. On 27 February 1981 a small Lace Monitor was trapped in a wire cage trap (35 x 15 x 15 cm) in mature heathland with an overstorey of Broad-leaved Peppermint (*Eucalyptus dives*) and Messmate (*E. obliqua*) approximately 3 km S.E. of Toms Cap. A semi-digested Gould's Wattled Bat (*Chalinolobus gouldii*) was also found in the trap (Museum of Victoria C26471).

Gould's Wattled Bat and the Lace Monitor are probably common in the area (Norris *et al.* 1979). This bat species roosts in crevices under bark and in hollows of mature trees in eucalypt forest. However, it is not known whether it was taken alive or as carrion. To the authors' knowledge this is the first instance of bats being recorded in the diet of the Lace Monitor. Forest bats are uncommon food items of feral cats, dogs, foxes (Triggs *et al.* 1984, Jones and Coman, 1981) diurnal birds and, to a lesser extent, nocturnal birds of prey (Young 1980). Also there is one record of Gould's Wattled Bat being found inside a Tiger Snake (*Notechis scutatus*) (Museum of Victoria C18106).

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F.N.C.V. KINGLAKE RESERVE

Any members with natural history records (plants, mammals, insects, etc.) and particularly photographs of the F.N.C.V.'s Harold Frahm Reserve at Kinglake are asked to contact the Honorary Secretary.

Specimens of Interest in the J.C. Le Souef Collection of Australian Butterflies

By K. L. Dunn*

Abstract

New and interesting distribution records and a list of type specimens are recorded from the J.C. Le Souef butterfly collection.

Introduction

The late J.C. ("Zoo") Le Souef (1905-1982) contributed much to Australian entomology during his life, and his butterfly and moth collection, comprising about 9,500 specimens, is of considerable scientific and taxonomic value as much of his material originated from remote Australian localities from which few specimens exist in other collections. Some records which represent previously unpublished range extensions are discussed and a list of type specimens is presented. Most specimens mentioned were taken by either J.C., his wife K.M., or son N.S. Le Souef. The Le Souef collection including other groups not examined by the author is now preserved in the Australian National Insect Collection (ANIC), CSIRO Canberra.

New and Selected Interesting Distribution Records

HESPERIIDAE

Trapezites phigalia phigalia (Hewitson)

One male labelled "Evans Head NSW 16 Sept 1977 C. G. Miller" represents the most northern coastal record for the nominate subspecies. Although the orange central band on the hindwing is slightly restricted, the specimen is otherwise identical to material from Grafton, New South Wales (ANIC). The dark-grey ground colour beneath immediately separates the Evans Head specimen from specimens of *T. p. philus* Waterhouse in the ANIC from south eastern Queensland.

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Pasma tasmanica (Miskin)

A single male labelled "Halls Gap 8 Nov 1942 Le Souef" represents the first record of this species from the Grampians, western Victoria.

Hesperilla donnysa ssp (Hewitson)

One female labelled "3 Springs W.A. 4 Sept 1958 Le Souef". Three Springs is about 140 kilometres south east of Geraldton. This specimen may belong to the subspecies *H. d. galena* Waterhouse described from the Geraldton district. In Western Australia *H. donnysa* was not previously known from between Fremantle and Geraldton (Common and Waterhouse, 1981).

Two males and four females, Tooboorac Vic. 10 Oct – 26 Nov 1980 J.C. Le Souef (some ex pupa). Tooboorac (near Heathcote) is north of the distribution boundary for *H. d. patmos* Waterhouse provided by Common and Waterhouse (1981).

Four males and two females, Lorne V. 9-19 Nov 1943 Le Souef. *H. donnysa* has not previously been recorded from this section of the Victorian coastline.

The subspecific status of these *H. donnysa* specimens cannot be determined with any certainty until more material comes to hand.

Hesperilla idothea idothea (Miskin)

One female labelled "Lorne Vic 15 Mar 1980 J.C. Le Souef". This represents the most western record for the nominate subspecies in Victoria.

Hesperilla idothea clara Waterhouse

One female labelled "Dartmoor V. 4 Dec 1972 J. C . Le Souef E.P." Although known from the far south east of South Australia (Common and Waterhouse, 1981), this species has not previously been recorded from the adjacent coastal area of western Victoria.

Hesperilla chrysotricha ssp (Meyrick & Lower)

One male labelled "Eucla W.A. 20 Oct 1967 J.C. Le Souef". Eucla represents a considerable extension to the range of this hesperiid in Western Australia. Until further material is available the subspecific status of this specimen must remain unresolved.

Oreisplanus peronatus (Kirby)

Two females labelled "Goulburn NSW 17 Nov 1966 E.P. J.C. Le Souef" and one female similarly labelled but 25 Nov 1966. This represents an interesting inland record for this species in New South Wales.

Antipodia atralba atralba (Tepper)

One male labelled "Fraser Ra W.A. 18 Oct 1967 J.C. Le Souef". This specimen represents the first record of the nominate subspecies from Western Australia.

Suniana sunias sauda Waterhouse

One female labelled "Wyndham W.A. 10 July 1969 J.C. Le Souef" represents the first record of this species in Western Australia.

Telicota sp. Moore

One damaged specimen labelled "Lake Hart S.A. 19 August 1971 J.C. Le Souef E.P." This specimen was detailed by Fisher (1978). Common and Waterhouse (1981) suggested it might possibly be *T. ancilla* (Herrich — Schaffer).

PAPILIONIDAE

Cressida cressida cressida (Fabricius)

One female labelled "Mt. Isa Q. 4 Aug 1958 R. Howard". The specimen appears indistinguishable from the nominate subspecies. A locality 65 kilometres south west of Mt. Garnet was the former most inland record for this state (Common and Waterhouse, 1981).

PIERIDAE

Catopsilia pyranthe crokera (W.S. Macleay)

Two males labelled "Blairgowrie V. 21 Apr 1955 Le Souef" and three males labelled "Sorrento V. 23 Apr 1955 Le Souef". Specimens were of the pink antennal form, lacteola. McCubbin (1971) gave a descriptive report of this migration into Victoria.

Eurema laeta lineata (Miskin)

One male labelled "Yeppoon Q. 21 July 1962 J.C. Le Souef". This species has only recently been recorded from central Queensland; 50 kilometres south of St. Lawrence (De Baar, 1983). Yeppoon represents the most southern record for this species. The specimen is now in the author's collection (J.C. Le Souef; donated).

Elodina padusa (Hewitson)

A single specimen labelled "Mataranka N.T. 18 July 1969 J.C. Le Souef". This represents a northern record of this species in the Northern Territory.

Elodina sp. C. & R. Felder.

Two males labelled "Iron Range Q. 15 July 1968 J.C. Le Souef" may belong to an undescribed species. Both specimens in general resemble *E. perdita* Miskin, however the hindwing underside is lemon yellow. There is a similar specimen in the ANIC, also from Iron Range, taken by Atkins.

Delias aganippe (Donovan)

One female labelled "Yeppoon Q. 30 Nov 1965 N.S. Le Souef". The species is infrequently taken in central Queensland. Reeves (1971) recorded two females from Erskine Island. Although there is another female from Yeppoon in the ANIC, Yeppoon lies east of the *D. aganippe* distribution boundary for central Queensland, presented by Common and Waterhouse (1981).

Appias melania (Fabricius)

One badly scratched male labelled "Yeppoon Q. 1 Dec 1965 N.S. Le Souef" represents the first central Queensland record for this species.

NYMPHALIDAE

Euploea eichorni Staudinger

One male specimen labelled "Edungalba Q. 1964 E. Adams". E.E. Adams (pers.

comm.) believes the specimen is incorrectly labelled. Proserpine, Queensland (Common and Waterhouse, 1981) thus remains the most southern locality for this species.

(Note: *E. eichorni* is now regarded as conspecific with *E. alcathoe* Godart (Ackery and Vane-Wright, 1984; p153).

Hypocysta irius (Fabricius)

One female labelled "Moolooloo N.T. 15 May 1972 D. Watson". There are no other records of *H. irius* from the Northern Territory. This record therefore requires confirmation.

Heteronympha solandri ssp. Waterhouse

Eight males and five females labelled "Mt. Cole Vic. 18 Feb 1980 J.C. Le Souef"; and six males labelled "Mt. Cole Vic. 9 Feb 1977 J.C. Le Souef". Specimens from Mt. Cole, western Victoria, differ from both described subspecies, particularly in the color, and the extent of the markings on the underwing surfaces.

Tisiphone helena (Olliff)

One female labelled "Edungalba Q. E. Adams". E.E. Adams (pers. comm.) believes this specimen is incorrectly labelled. Paluma, north Queensland (Common and Waterhouse, 1981) remains the most southern locality for this species.

Tisiphone abeona morrisi Waterhouse

Two pairs of *T. abeona* (Donovan) reared from larvae reputedly from Caloundra are identical to *T. abeona morrisi.* (One male labelled "Caloundra Q. 6 Dec 1957 Le Souef"; one male and one female similarly labelled but with date "12 Dec 1957"; one female labelled "Caloundra Q. 14 Dec 1957 N. Le Souef".) Common and Waterhouse (1981) recorded Southport as the most northern locality for *T. abeona morrisi.*

All other specimens of *T. abeona* in the ANIC labelled "Caloundra" are typical of *T. abeona rawnsleyi* which ranges from Beerwah (south of Caloundra) to Poona near Maryborough, Queensland. (Specimens from both of these localities are in the author's collection). In addition there is one specimen (Museum of Victoria) taken at Mt. Tamborine on 10 Jan 1903 (collector unknown) which is similar to *T. abeona rawnsleyi.*

T. abeona morrisi from Caloundra represents an unexpected distribution record. It would be interesting to have this data confirmed but unfortunately the stated collecting site has since been destroyed (K.M. Le Souef pers. comm.).

Junonia hedonia zelima (Fabricius)

One male labelled "Mataranka N.T. 24 July 1971 J.C. Le Souef". Le Souef (1971) recorded Mataranka as a locality for this insect. Mataranka lies south of the *J. hedonia* distribution boundary for the Northern Territory presented by Common and Waterhouse (1981).

Neptis praslini staudingereana de Niceville

One specimen bearing the label "Edungalba Q. 1964 E. Adams". E.E. Adams (pers. comm.) considers this specimen to be incorrectly labelled. Conn Creek, 21 kilometres south east of Cardwell, Queensland (Common and Waterhouse, 1981) therefore remains the most southern locality for this species.

LYCAENIDAE

Ogyris barnardi barnardi Miskin

One female labelled "Melville Caves V. 13 Oct 1977 J.C. Le Souef E.P.". There are no other records of *O. barnardi* from Victoria. This record therefore requires confirmation.

Ogyris sp. Westwood

One male labelled "Kellerberrin W.A. 20 Sept. 1958. Le Souef". Common and Waterhouse (1981) suggested that the specimen may belong to *Ogyris barnardi* Miskin. Although the specimen in general resembles *O. barnardi,* the white cell bars on the forewing beneath show a similarity to *O oroetes* Hewitson.

Ogyris oroetes apiculata Quick

One female labelled "Mt. Hope Vic. 6 Oct. 1976 J.C. Le Souef E.P." The pupa was apparently taken from an *Acacia mearnsii* De Wild bearing the mistletoe *Amyema quandang* (Lindl.) Tiegh. Sys-

tematic searching by several enthusiasts has failed to produce additional specimens. The present lack of confirmation does not discredit this record as there is a specimen of *O. oroetes* (in ANIC) taken in New South Wales at 26 miles (41.9 km) east of Mildura. Unfortunately the Mildura specimen emerged deformed and as a result subspecific determination was not possible. Additional material from either of these or adjacent regions would be of considerable importance in establishing the range limits.

Ogyris oroetes ssp. Hewitson

One damaged male labelled "Daly R. NT. 9 July 1971 J.C. Le Souef" represents the first record of this *Ogyris* species from the "Top End" of the Northern Territory. The specimen is purple above and appears similar to specimens from Alice Springs in the ANIC. The condition of the Daly River *O. oroetes* is too poor to make any comment on the width of the terminal black margins. Due to scarcity of material, the subspecies status of the purple form of this species has not been determined.

Candalides hyacinthinus simplex (Tepper)

Four males and four females, Rushworth V. 29 Oct, 1 Dec, 22 Feb, 1945, 47 Le Souef. Bendigo (Thorn, 1921) was the previous most eastern record for *C. h. simplex* in Victoria. Rushworth represents a central Victorian record and extends the known distribution by about 70 kilometres.

Danis hymetus ssp. (C. & R. Felder)

Ten males, Cooktown Q. 4 July — 3 Aug. 1964, 68, 69, 70, 79 J.C. Le Souef. The McIvor River, about 40 kilometres north of Cooktown is the most southern known locality for *D. h. salamandri* W.J. Macleay (Common & Waterhouse, 1981). Specimens from Shiptons Flat, about 37 kilometres south of Cooktown are closer to *D. h. taletum* (Waterhouse & Lyell). Specimens from Cooktown are variable but appear to tend towards *D. h. salamandri.* The condition of the Cooktown material did not permit subspecific identification with any certainty.

A List of Type Specimens in the Collection

HESPERIIDAE

Hesperilla crypsargyra lesouefi Tindale, 1953

The following five specimens were collected during Le Souef's 1950 visit to the Grampians, Victoria. Three males labelled "Mt. William V. 4 Dec 1950 Le Souef". One male labelled "Halls Gap V. 23 Nov 1950 Le Souef". One female labelled "Halls Gap V. 1 Dec 1950 Le Souef Bred".

The label data on these specimens does not agree with the rather general information in Tindale (1953) but I consider that the specimens should be regarded as paratypes.

LYCAENIDAE

Ogyris oroetes apiculata Quick, 1972

One paratype male: "3 Springs W.A. 4 Sept 1958 J.C. Le Souef". One paratype male : "Coolgardie W.A. 21 Sept 1967 J.C. Le Souef". Two paratype males: "Kellerberrin W.A. 3 Oct 1958 Le Souef". One paratype male: "Kellerberrin W.A. 10 Oct 1958 Le Souef". One paratype female: " Coolgardie W.A. 21 Sept 1967 K.M. Le Souef". Quick (1972) lists an additional paratype female from Eucla, Western Australia, which is now lost.

Virachola smilis dalyensis Le Souef & Tindale, 1970

One paratype male: "Daly R. N.T. 30 June 1969 J.C. Le Souef". One paratype female (labelled "allotype"): same label data as male. Le Souef and Tindale (1970) give date of capture of the paratype male as 29 June 1969.

Candilides consimilis goodingi (Tindale, 1965)

One paratype male: "Warragul Vic Mar 1939 J.C. Le Souef".

Theclinestes onycha capricornia Sibatani & Grund, 1978

Two paratype males: "Springsure Q. 2 Oct 1974 J.C. Le Souef", Sibatani and

Grund (1978) give date of capture as 20 Oct 1974.

Theclinestes hesperia hesperia Sibatani & Grund, 1978

Two paratype females: "Bunbury W.A. 1 Oct 1967 J.C. Le Souef".

Theclinestes hesperia littoralis Sibatani & Grund, 1978

Two paratype males: "Esperance W.A. 13 Oct 1967 J.C. Le Souef". One paratype male: with same label data except "14 Oct 1967". One paratype male and one paratype female; "Esperance W.A. 14 Oct 1967 K.M. Le Souef".

Tindale (1953) mentioned a specimen of *Pseudalmenus chlorinda fisheri* Tindale taken on Mt. Rosea in the Grampians, Victoria in November 1941 by Le Souef but recorded the specimen as lost. Tindale did not examine this specimen at the time of description (M. Le Souef pers. comm.), so I believe it should not be regarded as a paratype. The specimen is now present in the Le Souef Collection.

Acknowledgements

I wish to thank Mrs. K.M. Le Souef for helpful information and for allowing me to examine the collection at Blairgowrie Victoria; Mr. E.D. Edwards and Dr. E.S. Nielsen (Division of Entomology CSIRO) for their critical reading of the manuscript; and Messrs. C.E. Aston, A.F. Atkins and L.E. Dunn for additional helpful comments.

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F.N.C.V. CONSERVATION WORKERS

Conservation is a major concern for Field Naturalists and the appreciation of our environment by naturalists leads directly to the urge to conserve it. For this reason the Club founded the position of Conservation Co-ordinator some years ago, a position which remains unfilled after the May 13 Annual General Meeting.

People are continually needed to prepare comments on government documents such as Land Conservation Council recommendations which the Club should, or is asked to examine.

If you have the time and enthusiasm to occupy the position of Conservation Co-ordinator or to participate in the conservation committee please contact the Honorary Secretary.

The Pollination of *Bulbophyllum weinthalii* R. Rogers

By David L. Jones*

Flowers on cultivated plants of *Bulbophyllum weinthalii* are actively pollinated. This paper outlines details on the pollination process as observed on plants grown in south-eastern Queensland, in an area adjacent to where the orchid occurs naturally.

Orchid Biology

Bulbophyllum weinthalii is a fairly rare orchid of localized distribution, being confined to the ranges of north-eastern NSW and extreme south-eastern Queensland. It grows as an epiphyte in open forest country and appears to have a host specificity for the rough scaly bark of the Hoop Pine *(Araucaria cunninghamii)* (Dockrill 1969). The orchid is found in small, densely massed patches usually on the trunks and upper branches of this species. Plants have a neat compact growth habit of small rounded pseudobulbs set close together. The younger pseudobulbs are topped with a flat blunt leaf 15-20 mm long. This is shed after two or three years although it may be retained longer under good conditions. The new growths are covered with a white fibrous sheath which lasts about 12 months before it begins to break down and shred. Flower spikes arise from the base of the pseudobulb and break through the fibrous cover. Each bears a solitary flower.

Floral Details

The flower is about 18 mm across and is easily the most attractive of the Australian species of *Bulbophyllum*. It opens widely and is a waxy cream colour suffused with irregular purplish spots and blotches. Each flower is borne singly on a somewhat thin, weak peduncle, not much longer than the pseudobulbs. The flowering period is from March to May.

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The mechanism to achieve pollination is simple but effective. The flower is open, flat and broadly triangular in outline with the large lateral sepals making up the bulk. These organs are extremely broad at the base where they are united with the column. Near the column foot they are incurved to form two small pouches. The labellum is very thick and fleshy, deep red in colour and hinged to the column foot. Its weight is distributed towards the front so that in the normal position it lies at an angle just below the horizontal leaning away from the flower. The labellum is tongue-shaped with a deeply grooved vee down the centre. The nectar is exuded in large droplets some of which coalesce and collect in the groove. Some nectar also flows down the labellum and collects near the column foot and in the small pouches formed by the lateral sepals. The column is broad and strongly winged with a large sunken and very sticky stigma. The pollinarium is a complex one consisting of two unequal pairs of pollinia attached directly to a broad viscidium. There is no movement of the pollinarium after attachment to the insect.

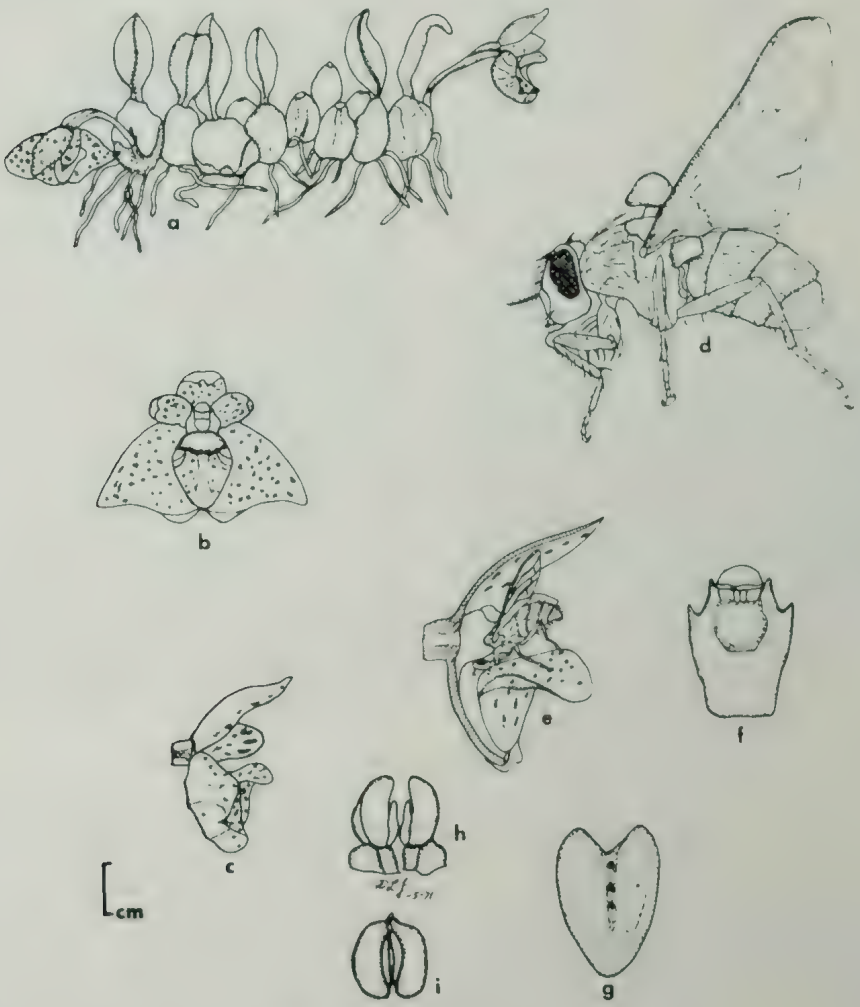
Pollination Syndrome

Nothing has so far been reported on the pollination of *Bulbophyllum weinthalii* and little is known of its efficiency in the field. Insect attraction is by means of a peculiar perfume that has a smell similar to fish meal. This smell is only released when the temperature rises above 15 °C and it becomes very noticeable on warm days. Reward is provided by the nectar which is released in large quantities from the labellum as outlined above. Each flower of *B. weinthalii* lasts about 7 days unless it is pollinated. Several flowers may be open at once and each contributes materially to the smell which wafts about a plant in flower.

Insect Behaviour

The orchid is pollinated by blowflies — specifically *Calliphora tibialis* Macq. This is a typical stout hairy blowfly that is distributed from Queensland to Tasmania. It is particularly common in the summer and autumn months and the larvae have been reported as parasitizing earth worms. *Calliphora* belongs to the family Calliphorinae which is a very significant group in Australia.

The flies are attracted to the plants by the smell released from the flowers. They actively seek them out and land anywhere,



Pollination of *Bulbophyllum weinthalii*.
a) portion of flowering plant showing habit 1 x indicated scale.
b) flower from front 2 x indicated scale.
c) flower from side 2 x indicated scale.
e) partial longitudinal section of flower showing *Calliphora tibialis* in position 3 x indicated scale.
f) column from front 6 x indicated scale.
g) labellum 5 x indicated scale.
h) pollinarium from below 10 x indicated scale.
i) pollinarium from above 10 x indicated scale.

not necessarily on the flowers. They wander erratically about, touching various surfaces with their proboscis. Upon reaching a flower they begin actively sucking the nectar from the sepals and labellum. Some have been observed to spend many minutes sipping from the pool formed at the junction of the column foot and lateral sepals before moving onto the labellum. They usually crawl onto the tip of this organ causing it to tip outwards under their weight. The fly crawls upwards probing in the vee for the nectar. As it passes the point of balance the labellum tips and the fly is slammed against the column where it may become wedged for up to 60 seconds. In this position it struggles and buzzes its wings quite vigorously, usually succeeding in picking up the pollinarium on its thorax between the wings. The deep vee in the labellum aids in the entrapment of the insect and also ensures the correct insect does the job. Blowflies larger than *Calliphora tibialis* are also attracted to the flowers but do not achieve pollination while smaller flies may become completely entrapped and perish. Pollen deposition is achieved by the same means although the flies may be trapped for several minutes before the pollen is dislodged into the very broad sticky stigma. Although the size for pollination of *Bulbophyllum weinthalii* is not extremely critical it seems obvious from the variation exhibited that some specimens of *C. tibialis* would be unable to achieve pollination of this orchid, and some may become fatally entrapped.

The pollination of *Bulbophyllum weinthalii* is consistent with the syndrome established for overseas members of this genus (van der Pijl and Dodson 1966). Studies of other Australian *Bulbophyllum* species show similar relationships with Dipterans (Smythe 1969, Jones & Gray 1976), although this is the only species with flowers large enough to be pollinated by blowflies.

Acknowledgements

The author wishes to express thanks to Dr D. H. Colless, Curator, Division of Entomology, C.S.I.R.O. for identification and notes on the pollinator and to June Dunlop and Barbara Jones for typing the manuscript.

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VACANCIES FOR OFFICE BEARERS

At the Annual General Meeting on May 13, a number of positions were not filled. The most pressing needs at present are for an Assistant Treasurer to help Noel Disken with the books and financial records and to fill in for him when he takes leave later this year, and for a Vice President. Brian Smith, elected president once again, intends to remain in the position for only one year.

Thre are also vacancies for an Assistant Secretary, Assistant Librarian and Conservation Co-ordinator. If you are interested or would like to know more please contact the Honorary Secretary, or for the Assistant Treasurer's position, the Honorary Treasurer.

Land Planarians (Turbellaria: Tricladida: Terricola) Introduced into Australia — 1. *Bipalium kewense* Moseley, 1878

BY L. WINSOR*

The cosmopolitan land planarian *Bipalium kewense* was first described by Moseley (1878) from a single specimen found in a hothouse at the Royal Botanic Gardens, Kew, England. It is now recorded from some 47 countries having been spread worldwide together with rooted plants. The natural range of the species extends from northern Viet-Nam to southern Kampuchea. Its normal habitat is probably upland tropical rainforest. Elsewhere *B. kewense* is confined to areas of cultivation or urban situations.

This paper provides a brief description of the species together with details of specimen and literature records for Australia complementing a recent detailed revisionary study of the species (Winsor, 1983a).

Sources of specimen records together with registration numbers are indicated by the following abbreviations: The Australian Museum, Sydney (AM); British Museum (Natural History), London (BM); Museum of Victoria, Melbourne (MV); Queensland Museum, Brisbane (QM); Veterinary Research Institute Melbourne (VRI); Western Australian Museum, Perth (WAM) and the author's collection (LW). Only the principal synonomy is provided here.

Family: BIPALIIDAE

Genus: *Bipalium* Stimpson, 1857

Bipalium kewense Moseley

Bipalium kewense Moseley, 1878

Bipalium manubriatum Sharp, 1891

Sphyrocephalus kewensis (Moseley) Hallez, 1893

Placocephalus kewensis (Moseley) Graff, 1896

Placocephalus isabellinus Geba, 1909

Bipalium costaricensis Hyman, 1939

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Type Material

Neotype, AM. W19342 from Charters Towers, Queensland (Winsor, 1983a).

Other Material Examined

QUEENSLAND: Brisbane (AM. W2373; QM. G11637, G11638, G11641), and suburbs: Annerley(QM. G1002, G11639 sexual), Archerfield (QM. G11643), Carina (QM. G4890), Chelmer (QM. G11635), The Gap (QM. G9221), Graceville (QM. G11640), Herston (QM. G11642), Manly (QM. G5524), Mt. Gravatt (QM. G11636), Taringa (QM. G5504), and Wooloowin (QM. G131277); Charters Towers (AM. W19342 Neotype, sexual, W19343, Voucher specimen, LW.809, LW1372); Cooran (QM. G2036); Gympie (MV.MUZD 541); North Arm (QM. G2609); Townsville suburbs: Aitken-

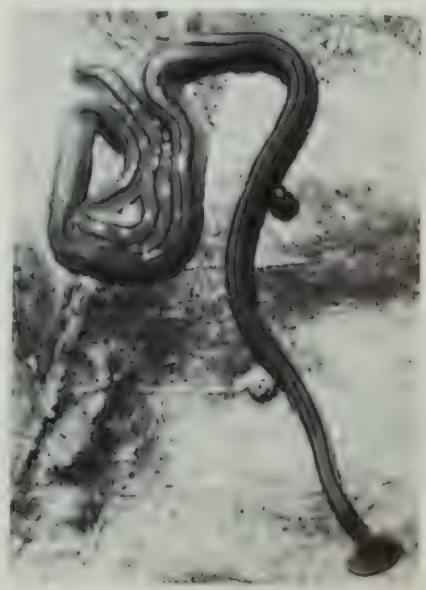

Fig. 1. *Bipalium kewense*. Mature specimen from Charters Towers, Queensland

vale (QM. GL65, Voucher specimen, LW1083, LW. 1373), Hyde Park (LW. 1122), Melton Hill (LW. 1361) and Queens Gardens (LW. 1155).

NEW SOUTH WALES: Sydney (AM. G1318, G11095, W206, W1540, W2187, W10213; BM. 1902.6.22-24, BM. 1924.8.13.571) and suburbs: Burwood (BM. 1924.8.15.572), Carlingford (AM. W2427), Chatswood (AM. W860), Double Bay (AM. W913), Edgecliff (AM. W1778), Petersham (AM. W414, W1719) and Strathfield (AM. W858); Gunnedah (AM. W10214), Kiama (AM. G2537).

VICTORIA: Melbourne suburbs: Balaclava (BM. 1924.8.15.569, 570), Richmond (VRI. 2128), South Yarra (MV. G823, G3217); Wodonga (MV. G3332).

WESTERN AUSTRALIA: Perth suburbs: Crawley (WAM. 2-78), West Leederville (WAM. 3-78); Coolup (WAM. 31-73, sexual); Kununoppin (WAM. 4-76).

Literature Records

QUEENSLAND: Gympie (Dendy, 1892); Brisbane and Townsville (Winsor, 1980); Charters Towers (Winsor, 1983a); NEW SOUTH WALES: Australian Museum Grounds, Dobroyde, Hyde Park, Marricksville, Surry Hills and University Grounds (Fletcher, 1887); Sydney (Anon, 1968; Pope and McMichael, 1961; Pope, 1974); VICTORIA: Eltham (Fletcher, 1891); Melbourne district (Winsor, 1973, 1979, 1983b).

Description

Living specimens (Fig. 1) may attain lengths up to 350 mm. The body is elongate with the anterior end expanded into a transversely semilunate-shaped head plate. Immediately behind the headplate the body narrows to form a "neck", gradually broadens to the maximum width over the pharyngeal region, then gently tapers to a rounded posterior end. In a sexual specimen 100 units long, the mouth is generally situated 47 units from the anterior end and gonopore 12 units posterior to the mouth.

Dorsal ground colour is usually a light ochre with five black to grey coloured longitudinal stripes (Fig. 2A): a median, paired lateral and paired marginal stripes which begin at or near the neck. The paired lateral and marginal stripes unite at the neck to form an incomplete collar (Fig. 2B) interrupted dorsally by a small median gap, ventrally by the creeping sole. Ventral surface (Fig. 2C) is a light ochre with white creeping sole often delineated by greyish-violet longitudinal stripes extending posteriorly from the collar.

Numerous minute ocelli are situated within the margin of the dorsal headplate, crowd at the neck and continue in a staggered submarginal row posteriorly. Sensory pits are situated in a pale zone around the anterior margin of the headplate. The pharynx is of the collar -form type.

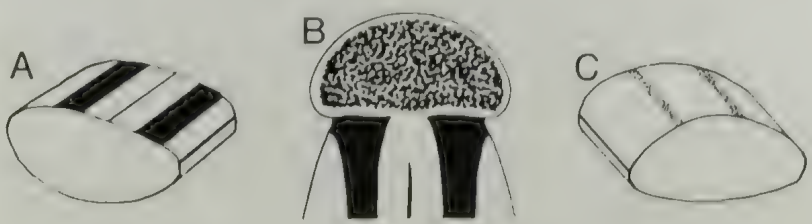

Fig. 2 *Bipalium kewense*. Commonest form of body markings. A — dorso-lateral, B — dorsal head and neck, C — ventro-lateral aspects.

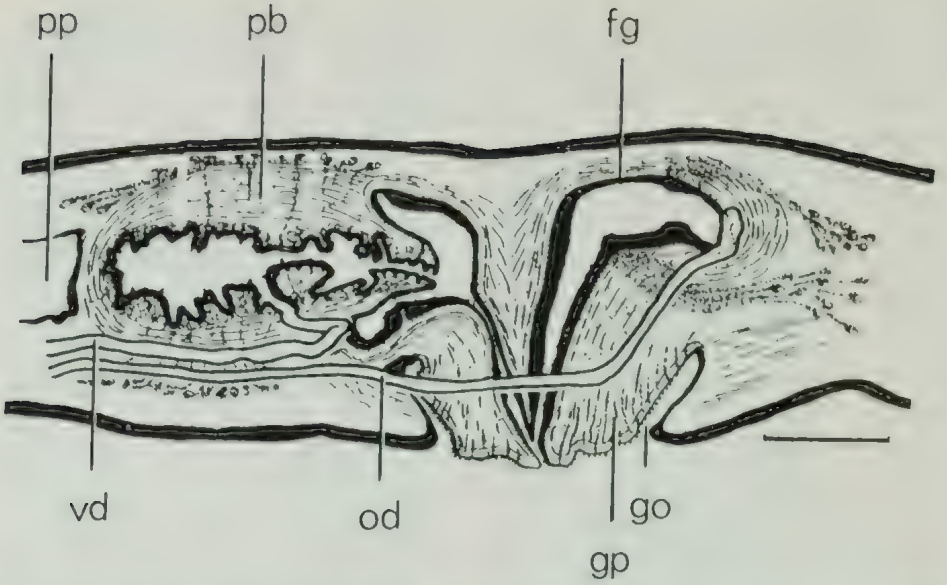

Fig. 3. *Bipalium kewense*. Copulatory organs. fg – female glandular organ; go – gonopore; gp – genital pad; od – ovovitelline ducts; pb – penis bulb; pp – pharyngeal pouch; vd – vas deferens. Scale bar represents 0.5 mm.

The copulatory organs (Fig. 3) lie immediately behind the distal end of the pharyngeal pouch. The penis and female glandular organ are elongate and pyriform. The male atrium and copulatory canal, together with the lower two thirds of the female canal and common genital canal are embedded in a highly muscular genital pad which occupies most of the common atrium. The vasa deferentia separately enter the mid ventrolateral walls of the penis bulb and open into the ejaculatory duct anterior to a prominent epithelial fold. The ovovitelline ducts enter the dorsolateral walls of the glandular canal separately. There are a single pair of ovaries, and some 180 pairs of testes which extend from the ovaries to the level of the mouth.

Specific Characters

Externally, the incomplete collar; median dorsal stripe not extending onto headplate. Although stripe pattern is distinctive, considerable variation in this and colouration has been noted.

Internally, the mixed musculature and form of the penis and female glandular canal; paths of the vasa deferentia and ovovitelline ducts within the copulatory organs as figured.

Occurrence

The species was first recorded from Sydney in 1874, four years before it was described from Kew Gardens, England (Fletcher, 1887). It is now found in the eastern Australian mainland states and in Western Australia (Fig. 4). Early records of *B. kewense* are generally from inner urban areas of capital cities, the more recent records from developing outer suburbs.

Habitats in urban and rural areas in which *Bipalium kewense* has been found include under or in potted plants, beneath wood shavings in a poultry yard, from within a soil clod, up to 30 cm deep within soil, in vegetable gardens, compost heaps and in plants and wrappings from nurseries. Specimens have been ingested and subsequently vomited by cats (Winsor, 1983b).

Reproduction in *B. kewense* can occur by two mechanisms: asexual reproduction by fissioning in which the last few centimetres of posterior are shed following

Fig. 4. The occurrence in Australia of *Bipalium kewense*. S — sexual specimen records.

feeding. Sexual reproduction occurs through cross fertilization between two individual planarians, with subsequent production of an egg cocoon which contains 1-2 young. This latter method of reproduction appears to be restricted to *B. kewense* in areas with tropical or subtropical climates (Fig. 4) — Perth, Western Australia; Brisbane, Charters Towers and Townsville, Queensland. Earthworms appear to be the sole food source of *B. kewense*.

Acknowledgements

I am most grateful to the following people who have kindly provided me with access to specimens and information: Dr. A. Adolph, Veterinary Research Institute, Melbourne; Dr. Lester Cannon, Queensland Museum; Ms. Alison Green, Tasmanian Museum and Art Gallery; Ms. Karen Handley and Dr. Pat Hutchings, Australian Museum; Dr. D. Lee, South Australian Museum; Dr. M. Malipatil, Museums and Art Galleries of the Northern Territory; Ms. L. Marsh, Western Australian Museum; Dr. Brian Smith, Museum of Victoria and Mr. and Mrs. N. Wake and Dr. J. Wake formerly of Townsville, Queensland.

Generous support by the C.S.I.R.O. Science and Industry Endowment Fund is gratefully acknowledged.

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Correction: Vol. 102 No 1 — The Land Nemertine *Argonemertes australiensis* (Dendy) in South Eastern Australia.

P. 30 line 31, left column should read TMH (V) K960 Lenah Valley, not THH K125.

Teratology in Two Species of Beetles (Coleoptera)

By C. E. Chadwick* B. L. Brunet**

Abstract

Teratological specimens of *Trogodendron fasciculatum* (Schreibers) (Col., Cleridae) and *Chrysolopus spectabilis* (F.) (Col., Curculionidae) are described and illustrated.

Teratology, the production of malformed animals and plants, is of occasional occurrence in insects. Two examples known to the authors seem to be worthy of note.

The yellow horned clerid, *Trogodendron fasciculatum*, has been recorded from the five mainland States. Froggatt (1923) described the life history and habits of the insect, which in the larval state is predaceous on the larvae of longicorn beetles boring in tree trunks, under the bark, etc.

An adult collected at a light trap at East Parramatta in October 1975 had an extraordinary right hind leg. The normal femur on the left hind leg is relatively long and parallel-sided, but the right femur is obviously shorter, roughly triangular and bears three tibiae and three tarsi (Fig. 1). Dorsally there is a groove between the first and second legs. When viewed postero-ventrally there is a deep cleft between the bases of the first and second tibiae (Figs. 2, 3). The third tibia arises posteriorly from a protruberance on the distal surface of the femur, and is bent near the point of attachment (Figs. 1, 2).

The first and second tibiae are approximately equal in length and about the length of the left hind tibia, but both are slightly curved when viewed from above. The tarsal segments and claws are normal.

The third tibia is markedly shorter than the other two tibiae, in fact the tibia and tarsus together only approximate the length of the tibiae of the other two legs. The tarsal segments and claws are normal, but smaller than their fellows.

Chrysolopus spectabilis the diamond beetle, was one of the species of insect collected on James Cook's visit to eastern Australia in 1770 and was described by Fabricius in 1775. It occurs in Queensland, New South Wales, Victoria and South Australia (Chadwick 1978). Froggatt recorded its food plants (1893) and gave a brief account of its life history (1923).

A malformed female was collected on *Acacia decurrens* at "Oak Flats", Araluen Valley, on 4 December, 1981. In this specimen the left side of the prothorax is normal, but the other side has abnormalities commencing about half-way between the anterior and posterior margins of the prothorax. The deformity really consists of two parts, which partly overlap (Fig. 4). The anterior protruberance arises from the lateral surface of the prothorax and projects laterally and ventrally. Laterally it bears a boss (umbo) with numbers of scales smaller than those on the rest of the body. Below this umbo the structure bends inwards and downwards, but curves outwards again to end in a concave depression containing numerous scales. The ventral surface below the depression is convex, brown, devoid of scales and has a longitudinal fossa. (This surface is hatched in the drawings). All dorsal areas are covered by green scales.

The posterior abnormality arises further posteriorly and from the latero-ventral aspect of the prothorax. It slightly overlaps the anterior protruberance and is in two parts, a proximal brown, segmented, seemingly cylindrical area and a distal flatter area. The distal section apparently has part of its ventral surface in-

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** 25 Vivian Street, Bexley, N.S.W. 2207.

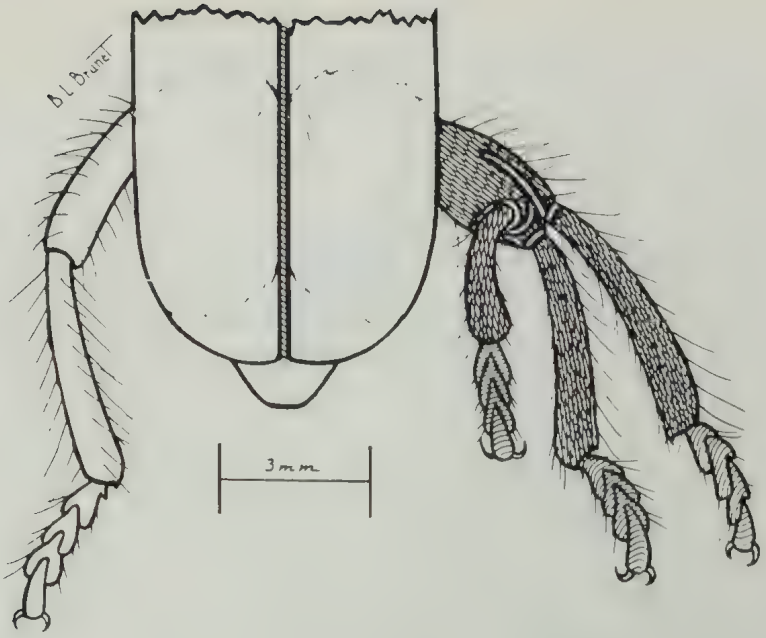

Fig. 1. *Trogodendron fasciculatum.* Dorsal surface.

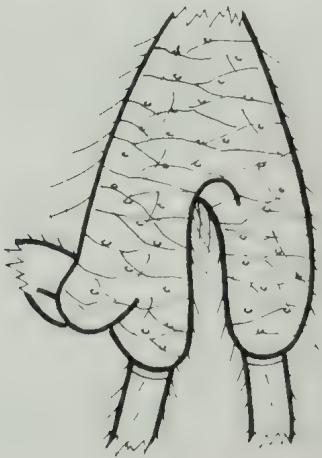

Fig. 2. Rear dorsal view.

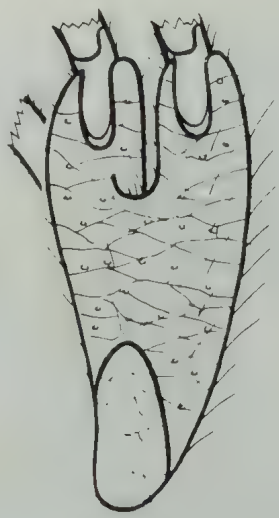

Fig. 3. Ventral surface.

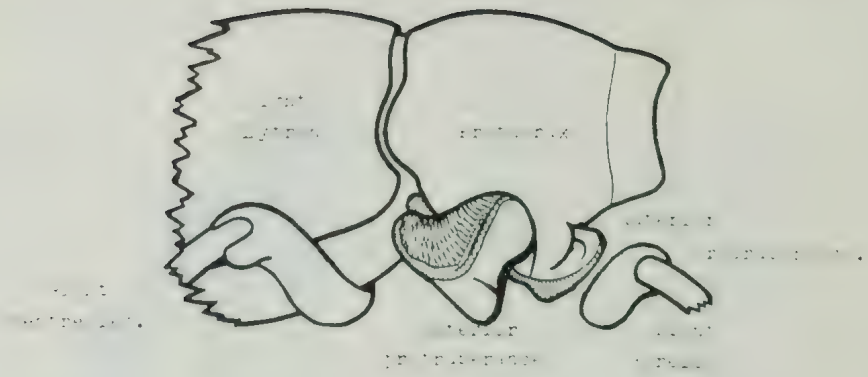

Fig. 4. *Chrysolopus spectabilis* (F.) Right side.

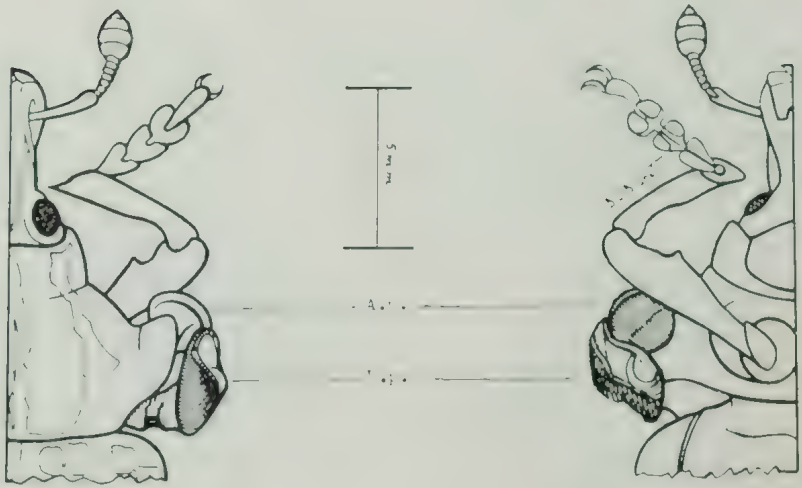

Fig. 5. Dorsal surface

Fig. 6. Ventral surface.

verted to become dorsally placed. This part is brown, irregular, slightly convex, lacks scales and is hatched in the drawing. The true dorsal area is black with quite small scales and bears two longitudinal grooves. So far as the ventral surface is visible it is brown, except for a small scales area (Fig. 6).

Both specimens have been donated to the Australian Museum collection.

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F.N.C.V. ANNUAL REPORT 1984-85

1984-85 has seen us taking stock of the finances and administration of the Club and further emphasis on publicising our activities.

The Nature Show was held on the weekend of 13-14 October at the Herbarium in South Yarra. With the participation of other Clubs and the able organisation of Mr Noel Disken it was a great success. Some 500 people attended but a financial loss was made since there was no admittance charge.

Advertising of Club meetings in The Age Weekender has continued to boost attendances at both General and Group Meetings with a number of visitors becoming members.

Grants totalling $1650 were received from the Department of Conservation, Forests and Lands for four projects — a regeneration study of the Club's Kinglake Reserve, new trapping equipment for the Mammal Survey Group, assistance with the M.S.G. Grampians Rock Wallaby Survey and the next Nature Show, to be organised by the Hawthorn Juniors. A Department of Management and Budget grant of $1500 for assistance with publication of the Victorian Naturalist was also received. For this assistance we are most grateful.

1984 saw the 110th anniversary of the founding of the Microscopical Society of Victoria, an incorporated group of the FNCV and late in the year we were sad to hear of the death of our oldest living member, Eulalie Bennett, who joined at age 18 and was awarded Honorary Membership in 1958.

The Club's Cosstick Wildflower Reserve near Maryborough was burnt out in the bushfires of January 14-15 with most fencing destroyed. The land was received as a bequest in 1958 and represents an excellent example of goldfields flora with a number of rare species being present. A maximum of $1,000 has been set aside to provide rabbit-proof fencing for the reserve for the first time.

The Australian Natural History Medallion was awarded to Mr Kevin Keneally for his work in botany and his service to natural history clubs, particularly in Western Australia. Seven Honorary memberships were awarded, the recipients being Mrs Eulalie Brewster, Mr Percy Wyatt, Miss Catherine Palmer, Mr Thomas Slatter, Mrs Eric Muir, the late Mr. Ken J. Simpendorfer, and the first Joint Honorary Members, Mr and Mrs R. H. Savage. The North East FNC and The Basin Junior FNC became affiliated Clubs, bringing the total of affiliates to 24.

As of December there were 738 members, including 101 Joint members, 44 Honorary members, 3 Life Members, 14 Student members and 158 Country members. In addition there were 172 subscribers to the Victorian Naturalist and 72 other bodies or individuals receiving the

Microscopical Group display at 1984 F.N.C.V. Nature Show. Photo: M. Howes.

publication. A membership subscription increase of $2.00 is proposed for 1986.

The Victorian Naturalist continued to appear with a five person Editorial Committee and Jenkin Buxton Pty. Ltd. remaining as printers.

Once again there was no contest for Office-bearer positions. Mr Noel Disken took over as Treasurer in May 1984 and Mr Ian Faithfull as Honorary Secretary in January 1985 from Mrs. Sheila Houghton. Mr Derrick Bevan was chosen as new Subscriptions Secretary.

Two bushwalks into mountainous areas, led by Jim Willis and John Milligan, were held with good attendance. Week-long excursions visited East Gippsland and the Warrumbungles, Mt. Kaputar and the Blue Mountains. Stream life was surveyed at the Acheron River led by Ros St. Clair. An insect excursion to Mt. Disappointment was led by Peter Carwardine. Two combined Victorian Field Naturalists Clubs Association camps were held at Ringwood and the Mornington Peninsula. An open day was organised for 21 October at the Club's Kinglake Reserve.

Topics covered at General Meetings were Forest Entomology, A Naturalist's Ramble through Africa, Crabs, The Wongan Hills Biological Survey, Wyperfeld Fire Ecology, Owls, The Radulae of Terrestrial Molluscs, Australian Mammalian History and Plants of the Kimberleys. A group discussion on Fire Regeneration took place at the September meeting as a followup to the 1983 work. The special interest groups continued to be active with varied meetings and excursions.

My thanks are due to the outgoing Council and Office-bearers for their hard work, dedication and support given to myself and the Club, and for thus contributing to a successful year of activities. More people with enthusiasm and interest are needed to continue these strong efforts. I regret the necessity of my retirement as President and wish the Club well in its ensuing years.

WENDY CLARK,
President.

FIELD NATURALISTS CLUB OF VICTORIA

Reports of recent activities

General Meeting
Monday, 15th April

Honorary membership was awarded to Mrs Florence Muir (wife of Eric), on completion of 40 years membership. On presenting the award Ros Garnet remarked that he has accompanied the Muirs on botanising expeditions to the Little Desert since the late 1940's. He described Mrs Muir's role (along with her husband) in establishing the Dimboola Wildfower Reserve.

Speaker for the evening was Stephen Forbes, a botanist from the National Herbarium, who spoke on "Plants of the Kimberley". At the outset Stephen explained why a Victorian botanist should find himself working outside of his State, viz. that it makes more sense to disregard State borders and for each Herbarium to make collections of the whole continent's flora. It is also a chance to procure propagating material for the Botanic Gardens.

With the aid of financial backing from several sponsors and the practical support of the armed services the expedition of scientists traversed areas previously uncollected.

Stephen gave a brief history of the area's history of discovery and exploration, which included an expedition by Mueller in 1855-56 into the southern part of the east side. This current expedition examined two areas, Napier Broome Bay and Vansittart Bay, both poorly known. There are 1568 native species listed for the Kimberley, which is probably a sizeable underestimate as there is a rich ephemeral flora which only emerges in the wet season

(Continued from inside front cover)

At the National Herbarium, Birdwood Ave., South Yarra at 8.00 p.m.

Botany Group — Second Thursday
Thursday, 13th June. Members night.
Thursday, 11th July. Walking in Tasmania National Parks. Betty Terrell.
Thursday, 8th August. Proteaceae. Madge Lester.

Geology Group — First Wednesday
Wednesday, 3rd July. To be announced.
Wednesday, 7th August. To be announced.

Mammal Survey Group — First Tuesday.
Tuesday, ?? July. To be announced.
Tuesday, ?? August. To be announced.

Microscopy Group — Third Wednesday.
Wednesday, 19th June. How to make a rock section. Mr. D. McInnes.
Wednesday, 17th July. Books on microscopy. R. Graham.
Wednesday, 21st August. Plant sections by C. Nance. Urwin Bates.

GROUP EXCURSIONS

All FNCV members and visitors are invited to attend Group Excursions

Botany Group
Saturday, 22nd June. Royal Botanic Gardens.
Saturday, 27th July. Sherbrooke Forest.
Saturday, 24th August. Mornington Peninsula.

Geology Group
Sunday, 11th August. Volcanic eruption points around Melbourne. Leader: Mr. G. Love.

Mammal Survey Group
June, 8th-10th. Rushworth Forest.
July, 13th-14th. Kernot.
August, 10th-11th. Grampians.

when the area is less frequented. Interestingly, the flora has more affinities with Africa than, say, south-eastern Australia, and there are some surprising occurrences. For instance, in the Bungle Bungle Range, an area that only receives 10-12 inches of rain annually, can be found isolated pockets of Monsoon forest.

Stephen presented slides of many of the plants he encountered including the Baobab tree, a eucalypt (*E. grandifolia*) which becomes deciduous in the dry season, and the only Banksia which occurs in the Kimberley (*B. dentata*).

Exhibits: There were a large number of exhibits as follows:
— the chitinous skeleton of a polyzoa from Westernport Bay.
— a sea-squirt *(Botryllus)* showing the reversability of the blood flow. In the same dish were Hydroids with gonosomes that will hatch out into minute jelly fish.
— sea-cucumbers (*Holothurians*).
— from a Day Group outing literature on Harpers factory in Port Melbourne which has been renovated into residential flats and offices.
— a specimen of the plant *Origiron mucronatus* (from Mexico) which had been found growing between bitumen and a brick wall.
— seeds of Cedar Wattle (*Acacia elata*) from near Mount Franklin.
— specimens of two birds from near Portland, Banded Landrail and Blue-winged Parrot.
— several rock and mineral specimens: volcanic olivine 'bomb' from Mount Laura, near Camperdown; quartz micro-crystals in brown coal from a mullock heap at Altona; a glacial pebble from Plymouth (New Zealand); black coal coated with coral.
— burrowing bugs of the family Cynidae, which have been found to feed on Acacia seeds.

Nature Notes: A report of a Bellbird nesting posed the question — is it late or early? In the gardens opposite the Arts Centre two Nankeen Night Herons were observed.

Conservation: Pauline Duncan from the State Government's Flora and Fauna task force spoke on the Flora and Fauna Guarantee, the aim of which will be the preservation of species and habitats through legislation. At present there is an immediate need to build up a data base for test cases which will be held in the Geelong and Dandenong regions shortly. The Government seeks the input of interest groups and individuals, who can be put onto a mailing list.

Field Naturalists Club of Victoria

In which is incorporated the Microscopical Society of Victoria

Established 1880

Registered Office: F.N.C.V., c - National Herbarium, Birdwood Avenue, South Yarra, 3141.

OBJECTS: To stimulate interest in natural history and to preserve and protect Australian fauna and flora.
Members include beginners as well as experienced naturalists.

Patron:
His Excellency Rear Admiral SIR BRIAN S. MURRAY, KCMG, AO.

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Day Group: Mr. D. F. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Geology: Miss HELEN BARTOSZEWICZ, 16 Euroa Avenue, Nth. Sunshine, 3020 (311 5106 A.H.)

Mammal Survey: Mr LANCE WILLIAMS, 29 Erica Crescent, Heathmont, 3135 (879 1962 A.H.)

Microscopical: Mrs ELSIE GRAHAM, 147 Broadway, Reservoir, 3073 (469 2509)

MEMBERSHIP

Membership of the F.N.C.V. is open to any person interested in natural history. The *Victorian Naturalist* is distributed free to all members, the club's reference and lending library is available and other activities are indicated in reports set out in the several preceding pages of this magazine.

Subscription rates for 1985

Metropolitan Members (03 area code)	$18.00
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Subscription to Victorian Naturalist	$16.00
Overseas Subscription to Victorian Naturalist	$22.00
Individual Journals	$2.50

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The Victorian Naturalist

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GENERAL MEETINGS

Monday, 12th August, 8.00 p.m.
Mr. Peter Cell. "Birds of Remnant Mallee Patches at Wedderburn." Honory memberships to be awarded to Miss Laura White and Miss Joan Forster.

Monday, 9th September, 8.00 p.m.
Members Night.

Monday, 14th October, 8.00 p.m.
Dr. Neil Hallam. "The Biology of Macquarie Island."

New Members — March/April 1985 General Meetings

Metropolitan

Mrs. Joan Anderson, 18 Grosvenor St., Brighton, 3186.
Ms. Margaret Blakers, 20 Heller St., Brunswick, 3056.
Miss Pauline Duncan, 3 Madden Grove, Kew, 3101.
Miss Jacqueline Gulbis, 18 Lower Rd., North Eltham, 3095.
Mrs. Ann Le Lievre, 57 Par Rd., Cheltenham, 3192.
Dr. J.H. Mitchell, 19 Tormey St., North Balwyn, 3103.
Dr. M.A. Steward, 13/7 Rockley Rd., South Yarra, 3141.
Mr. Arthur Singe, 22 Suffolk St., Wantirna, 3152.
Mrs. Myrtle Tatnell, 8 St. Neots Ave., Northcote, 3070.
Mr. Lindsay Ternes, 1 Ronald St., East Coburg, 3058.
Mr. John Woinarski, Zoology Dept., Monash University, Clayton 3168.

Joint Metropolitan

Mr. Bill and Mrs. Mibel Farrugia, 21 Glynns Rd., Warrandyte, 3113.

Country

Dr. Chris Bunn, Dept. of Agriculture, Bendigo, 3550.
Ms. Betty Reid, 92 Glenburn Road, Kinglake, 3763.
Mr. Ray Power, 36 Schotters Rd., Mernda, 3754.

FNCV EXCURSIONS

Saturday 31st August — Friday 6th September. Rotamah Island Bird Observatory. Check with E. Turner (861 8611) for vacancies. Details in March/April Naturalist.

Sunday, 1st September. Winneke Dam. The coach leaves Batman Ave. at 9.30 am. Fare $8.00. Bring picnic lunch. This is a comparitively new dam in the Christmas Hills - Yarra Glen area.

Saturday, 21st September. Spring walk in Stony Ck. area near Clonbinane. Private Transport. Leader: John Milligan (386 4305).

Saturday 5th — Sunday 6th October. Maryborough. Combined Victorian Field Naturalists Club Association weekend hosted by Maryborough F.N.C.. Tentative programme: Leave Maryborough Town Hall 1.20 pm. or Bristol Hill Hotel 1.30 pm. for Cosstick Reserve and Paddy's Range. Return to Maryborough FNC clubhouse for meal, meeting and campfire. Sunday morning a birdwatching walk or visit to aboriginal wells. Barbeque lunch at clubhouse. The club is prepared to put on a casserole dinner Saturday night and the barbeque on Sunday at a cost of $4.00 per meal. Please give Marie Allender your bookings for these meals. Coach fare and motel accommodation (room only) $50.00 should be paid by September General Meeting. Please let Marie know as soon as possible if you are interested. Members going by private cars should book own accommodation, or contact Maryborough F.N.C. about camping grounds. Coach leaves from Gas and Fuel Co. Flinders St., at 8.30 am. Bring lunch.

Saturday, 12th — Sunday 19th January 1986. Hobart. Fly to Hobart where accommodation is booked for the week. Day trips to Bruny and Maria Islands, Russell Falls, Harty Mountains, Risdon etc. Cost $450.00 at present but there may be an increase for late bookings due to higher air fares. Deposit of $200.00 with bookings please.

GROUP MEETINGS

FNCV members and visitors are invited to attend any Group Meetings.

Day Group — Third Thursday

Thursday, 15th August. Westerfolds Park (M.M.B.W.). Catch 10.34 am. bus no. 279 (Templestowe and Newmans Rd.) at the Cnr. Flinders and Russell Sts. Alight at Cnr of Porter and Williamson Sts. Leader Jim Lawson. 470 2271.

Thursday, 19th September. Maribyrnong Park. Catch 10.50 am. train to Essendon Station. Catch bus no. 465 on western side of Essendon Station at 11.25 am. Alight at Cnr. of Collins St. and walk south to Prospect St.. Leader Dan McInnes 211 2427.

Thursday, 17th October. Zoological Gardens. Meet at Royal Park Railway Station at 11.30 am. Leader Joan Miller 836 2681.

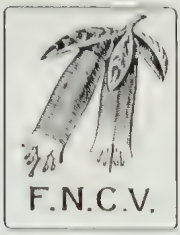
At the National Herbarium, Birdwood Ave. Sth. Yarra at 8.00 pm.

Botany Group — Second Thursday

Thursday, 8th August. "Proteaceae" Madge Lester.

Thursday, 12 September. "The Grampians" Ilma Dunn and Ian Morrison.

(Continued inside back cover)



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Impressions of Australian Mushrooms*

By Roy Watling†

Introduction

It is perhaps rather presumptuous of me to even consider, that I am able to discuss with any authority the Australian agaric flora after only two relatively short trips to Australia (1974 and 1982, eighteen weeks in all). Please consider this therefore only an account of my impressions which will stand or fall after future investigations, but if they encourage exploration I will be very pleased in knowing that inquiry into such an exciting flora is then under way.

The beauty of agaricology is that with no more than twenty four families fixed in one's mind any part of the world is in the palm of one's hand and will offer some interest amongst the bewildering array! This is in marked contrast to the differences between the flowering plant floras of N. America and Europe, and that of Australia where even the commonly seen families in Australia are unfamiliar to the Europeans. It is almost a cultural shock when one lands for the first time in Australia and experiences first hand the range of flowers and trees.

In Australia the twenty four families of agarics referred to above offer examples of endemism, introduced taxa and species with a world-wide distribution. Unlike Indian fungi, for which one can hypothesise the reasons for the various elements in the flora (Watling, 1978), Australian fungi only recently have stimulated sufficient interest in them to commence an unravelling of similar elements and their interconnections (Pirozynski & Walker, 1983). Although Australian fungi do not offer evidence of distinctive African and European invasions, colonization from Asia may have taken place in a period after the Indian subcontinent split from Gondwanaland and drifted north ultimately to collide with Asia to form the Himalayas; some markers are apparently recognizable. The original Gondwanaland fungal flora of Australia is undoubtedly intermixed with other fungal elements and future work will perhaps be able to separate it from the general background 'noise'.

There are undoubtedly in Australia introductions of relatively recent origin, e.g. those from north temperate countries, especially taxa at home with *Pinus radiata*, a tree which has been planted over huge swathes of land. *Suillus luteus* and *S. granulatus, Lactarius deliciosus, Amanita muscaria* and *Rhizopogon luteolus* are all such newcomers. The last example, *Rhizopogon*, grows in such quantity that square yards of forest track are thrown up by the profusion of fruiting bodies, a phenomenon for instance never seen in Britain. All the examples above seem to be as at home just as *Amanita muscaria* is in the *Pinus patula* stands of Southern India and *Suillus grevillei* is in Britain wherever the introduced larch (*Larix europea*) is to be found. So dominant are these N temperate species in Australia that it might be suggested they have formed almost pure stands in the absence of the competition from those species with which they would naturally occur with in N. America and/or Europe, and which apparently were not simultaneously introduced. Thus the plantations and conifer breaks found even in some of the most desolate places in Australia are characterised by non-endemic taxa, typical members of the boreal forest which originally probably migrated along with the Coniferae and colonized northern

*Modified from the text of a lecture delivered at several centres in East and West Australia including Victoria, during a tour of duty in April-May 1982, and to NAMA at its Samuel Ristich Foray, East Strandsburg, Pennsylvania, August 1982.

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areas from their tropical/subtropical mountain tops.

The Bolete flora

Except where introduced there are therefore no native Australian *Suillus* spp., and I do not know of any records of the other boreal genera *Gomphidius* and *Chroogomphus*. In addition there are no native *Leccinum* spp., although the genus can be found within a few miles of Government House in Canberra growing with introduced birches (*Betula*). The familiar *Paxillus involutus* is also found with introduced plantings of trees; I have collected it under poplars at Gosford near Sydney, New South Wales and Jim Willis has found it growing in the Melbourne Botanic Garden. The boletes of Australia are represented by many species with ornameted basidiospores, belonging to such genera as *Strobilomyces* and *Boletellus*, and in Queensland by *Heimiella* (Watling unpubl. data). It is rather interesting that Europe is depauperate in this group of boletes and although N. America can muster a few more species of the group, they are far more common in Australasia; at least one of the N. America taxa, *Boletellus ananus*, is so like the Australian *B. ananicepts* that many authorities consider them the same. Although *Boletus* spp. are widespread under *Eucalyptus* and are undoubtedly mycorrhizal with members of that genus, judging from the structure of the mycorrhizas (Chilton), many of the ecological niches in the wet sclerophyll and rain forests are taken not by *Boletus*, but by species of *Mucilopilus (= Fistulinella)* and the genus *Austroboletus*. *Pulveroboletus* is represented in Queensland by *Boletopsis icterinus*, perhaps indicating that this area was once connected with Malaysia, where the same fungus is found. *B. icterinus* is usually taken as a synonym of *Pulveroboletus ravenelii*, a bolete familiar particularly to those from the southern states of USA.

The abundance of bolete and tinkhorn (Phallales) taxa is one of the most striking differences between our N temperate floras and that of Australia. The Phallales is a group of fungi which have paralleled flowers in many ways in exploiting colour, shape, and smell to assist in spore dispersal. In Britain we have little more than a handful of species, some taxa being represented by single or very irregular records probably resulting from sporadic introduction from abroad. In N. America there are considerably more species recorded but hardly the profusion of taxa one experiences in Australasia. One of the less common British species is *Phallus hadriani*, a phalloid with purple tinted volva found in maritime sand-dunes; Tony Young (pers. comm.) has found this same species in the sandy areas of Kings Park, Perth on the West Coast of Australia. Phallales are a strange group within the Gasteromycetes and really represent a distant but parallel development to the agarics. These really have little to do with such Gasteromycetes as the Bird's Nest fungi.

One can muse at what might have been the outcome if Elias Fries had been an Australian, and what emphasis he would have then placed on the groupings of agarics. The classification which has weathered time is basically Europe-oriented and the Rev. M. J. Berkeley, the father of British and Australian mycology, adopted such a system when cataloguing the finds arriving in Europe during the nineteenth century (Berkeley, 1873; Berkeley & Broome, 1879). It was left to M. C. Cooke in Britain (1880-94) and McAlpine (1895) in Australia to draw all these early records and many more together. Fries himself had examined material from Australia, specimens which had been originally sent to the Hamburg Botanic Garden by Preiss (Hilton, 1982). F. von Mueller, a figure synonymous with early Australian botany, when curator at the Melbourne Botanic Garden also dispatched material to Europe to Kalchbrenner who published his results independantly (1880) and in collaboration with Cooke (1880).

Alas there was little activity in the study of agarics immediately after these workers passed on except for Cleland in S. Australia (1934) and Cheel with Cleland's help (1919-1931) in New South Wales; it is only now that an interest in mushrooms has been reawakened. Modern workers are now realising the folly of slavishly following the European texts, and are now looking further afield to Malaysia and the tropical Americas for inspiration and species-lists. This is reminiscent of a recent plea in McIlvainea (Cibula, 1982).

The Agaric flora: *Amanita* and relatives

Amanita muscaria forms ectotrophic relationships with various trees, the mycorrhizas having been successfully synthesised in pure (auxenic) culture. *A. muscaria* is placed in *Amanitaria* of *Amanita* but this section contrasts markedly with *Lepidella* whose members most of us in N. Europe are less accustomed to seeing; in morphology this latter section differs markedly from the familiar picture of an 'Amanita' as the constituent members may possibly form loose relationships with grasses in a similar way as some sand-dune agarics do with *Ammophila.* The section is represented by only a few British species and those that are found are uncommon and generally southern in distribution. In Southern Europe and North America except for the SW coast several more species are known but the majority of described taxa are recorded from South America, South Africa, and Australia, a link one hears of many times in relation to vascular plants. One species of this section which occured literally in hundreds in the 'Ginger' house in the Royal Botanic Gardens, Edinburgh is *A. nauseosa.* It was first described from Kew as a species of *Lepiota* by Elsie Wakefield (1918); and subsequently refound and illustrated by Derek Reid (1966). It has been recorded from Mexico by Guzman (1975), from India (Pegler, pers. comm.) and from Australia (Yound, 1982).

Section *Lepidella* represents a Mediterranean element with similar distributional pattern in Britain to the majority of members in *Lepiota* and *Volvariella.* Having been in Scotland now for nearly a quarter of a century I have learnt not to expect to find more than a couple of species of *Lepiota* s. lato (including *Macrolepiota*) in any one collecting season. In contrast one hour of foraying in Australia would realise this in minutes in the fruiting season in either wet or dry sclerophyll forests. In Edinburgh another agaric is common in the glasshouses and often accompanies *Amanita nauseosa.* It is *Leucocoprinus birnbaumii (= Lepiota lutea)* which has been also recorded from the Botanic Gardens at Glasgow, Belfast, Dublin, Paris, Berlin, Prague and at Kew, etc. etc. During my first visit I found it wild in the Woolam Heath near Bribie Island, north of Brisbane, Queensland although subsequently I learnt that it had been recorded from Ceylon by Thwaites in 1867 under another name (Pegler, 1972). Walter Sundberg tells me it is found in the Southern Central United States and in California and David Pegler (pers. comm.) records it as a constituent of the Caribbean flora. This interesting connection again links the subtropical parts of the Americas and Australia. *Lepiota* is a huge genus in Australia only in part touched by the studies of Jack Aberdeen (1962); the genus ranges from the beautiful snow white *L. dolicaula (Macrolepiota)* to the small, delicate *L. cinnamomea* and *L. fuliginosa.* The most widespread *'Lepiota'* is the chrome yellow, tough *Lepiota asprata* now placed in *Cyptotrama* (Tricholomataceae), because it differs so greatly in its structure from the true Lepiotaceae.

Volvariella except for one species, *V. speciosa,* is characteristically southern in distribution in the British Isles but it is this same species which is most commonly found in Australia probably having been introduced there. It is found in and around orange and apple orchards, and around disused farmsteads.

The genus *Termitomyces* which has

been placed by some authors close to *Amanita* (Singer, 1962) and which I thought at one time was more akin to the Tricholomataceae is probably closer in overall characters to members of the Pluteaceae (Pegler, pers. comm.). The genus is found in SE Asia, East Africa and Madagscar, and I have seen several of small taxa, sometimes separated out into the genus *Rajapa,* in Southern India, e.g. the University Campus in Madras. Although termites are common and economic pests in Australia the genus *Termitomyces,* so intimately connected with termites as the name implies, is unknown on the continent. The groups of termites which are involved in these fungus/insect relationships are apparently absent from Australia. If these termites were present millions of years ago along with their fungus association they possibly died out because of changes in world climate or, what is more likely, Australia split from Gondwanaland before the association was first formed; perhaps a hint of a possible relationship is illustrated by the genus *Termicola* described from slightly further north, New Guinea (Horak, 1979). In South and Central America the leaf-cutting ants, although unrelated to the termites, have taken up a parallel ecological association with agarics but in this case various fungi especially members of the Lepiotiaceae are involved.

An Agaric flora: Agarics with coloured spores

Perhaps one of the best documented mycogeographic patterns is the distribution exhibited by the members of the genus *Descolea* (Cortinariaceae) i.e., S. America, Japan, New Zealand, India and Australia. *D. recedens,* described originally by Cooke & Massee (in Cooke, 1889) as a *'Philiota',* was first found near Melbourne, Victoria and this is the only location in Australia on Horak's map when he monographed the genus (1971). Since then I have found the same species in New South Wales, Tasmania, Victoria and Queensland (see Horak, 1983) and there is evidence of a parallel taxon in Western Australia (Young, pers. comm.). At first it was thought to be associated only with *Nothofagus* forests but it is doubtful whether *Nothofagus* was ever present at Merdiallic in Victoria even at the end of the last century. *Descolea recedens* appears to be equally at home in a wide spectrum of habitats from wet sclerophyll to rain-forest communities; it has been found also with *Leptospermum* (Myrtaceae) in Centennial Park no less than a mile or so from the Sydney Harbour bridge. The Australia rain-forest is often termed Indo-Malaysian and it has been suggested that this kind of vegetation covered many areas of Australia and was ousted by the eucalyptus as climatic anthropogenic changes took place. More collecting in these areas will undoubtedly explain the distribution of *Descolea* spp. in Autralasia (Horak, 1983) and explain further distributional patterns. Parallels are seen in the distribution of the very curious Beech strawberries, *Cyttaria* (Ascomycotina) outlined by Korf (1983), but this fungus is truly confined to *Nothofagus.*

Amongst familiar genera of the Cortinariaceae both introduced and native taxa are found. *Gymnopilus junonius,* probably better known as *G. spectabilis,* is a familiar sight growing on eucalypt and on pine stumps but careful comparative study is required to distinguish this from the S. American *G. pampeanus.* The genus, however, is a widespread and important group of wood rotters but as in every continent the genus *Cortinarius* is both dominating, and intimidating, appearing in the eucalypt forests in scores of different and bewildering taxa. Many familiar shapes and colours are found but none of them tie up really convincingly enough to be able to give to the basidiomes N. America or European names, even the chemicals my colleagues have identified in them are different. Incidentally whilst dealing with the Cortinariaceae mention should be made of the

'Ghoul fungus', which is frequently found fruiting in close proximity to small dead mammals or animal burrows (Hilton, 1978). It is related to the N. American *Hebeloma sarcophyllum* and the European *H. porphyrosporum; H. radicoscum* also has similar bizarre food requirements. Apparently its recognition as a *Hebeloma* has solved the sticky problem of the identity of the genus *Metraria* (Holland & Pegler, 1983) which as *H. sarcophyllum* and *H. porphyrosporum* was characterised by a purple-brown spore-print.

Members of the Bolbitiaceae are not very common in Australia perhaps because of the presence of few natural base rich communities but as soon as treatment with fertilizer is carried out members soon appear, along with several familiar temperate *Agaricus* spp., including *A. campestris* and *A. arvensis,* and *Chlorophyllum (= Lepiota) molybdites.* The first two species are apparently cosmopolitan whilst *C. molybdites* is more confined to the warmer parts of the world in parallel to several other species, e.g. *Psilocybe cubensis.*

The Agaric flora: some biological relationships

These last fungi are adapted to dung and similar highly nitrogenous substrates but the Australian flora is characterised by several agarics and related fungi adapted to fire; such a flora is unknown in Europe and India and certainly is not known to a parallel extent in N. America. *Polyporus mylittae* is one such fungus; it forms a huge underground sclerotium called 'Black fellow's bread' and fruits by producing large terrestrial bracket fungi, after fire has passed over the area in which the sclerotia are buried. *P. tumulosus* springs, in contrast, from a pseudosclerotium composed of sand-grains tightly held together by interlocking myscelium to form a long stone-like cylinder. With the burning of the litter as the fire travels through the forests many other taxa are stimulated to fruit including boletes and many large colourful coral-fungi in the genus *Ramaria,* and the long rooted *Cortinarius radicatus.* It is possibly because of the deep piles of leaf-litter and bark ribbons which accumulate in eucalypt forests and act as fuel for these fires that *Boletellus ananiceps* favours fructification high up on stringy bark eucalypts, the spores being shed then in turbulent air above the stagnant atmosphere on the forest floor.

Many rain-forest areas of Australia contain the southern beeches; trees of the genus *Nothofagus,* making their greatest development in Tasmania where not only is the forest tree *N. cunninghamii* found but a small, deciduous species, the Tangle Foot, *N. gunnii.* It has been possible to recognise in Tasmania species of *Cortinarius* and *Tricholoma,* resembling those illustrated by Marie Taylor for *Nothofagus* woodlands in New Zealand (1981). Several species of *Rozites* have been recorded from New Zealand (Horak & Taylor, 1982) but only *R. australiensis* is known from Australia and even this is really not a *Cortinarius* at all! In addition the name may refer to a complex of closely related taxa. It is a huge fungus almost competing in weight and dimensions with the enormous *Boletus portentosus,* a bolete placed by some in the genus *Phaegyroporus. Rozites,* however, may not have been eliminated from the Australian scene by proving Cleland and Cheel's species is a *Cortinarius* because under *Armillaria* in the Herbarium of the University of Western Australia, Nedlands, I found a true *Rozites* and Alan Mills has collected a distinct as yet unrecorded species in Tasmania (pers. comm.). Perhaps these finds will prove to be an indicator of the similarities in fungal flora which have been suggested between W. Australia and New Zealand (R. Hilton, pers. comm.).

Many small agarics live and fruit amongst, and on, these same bark ribbons and leaves, or amongst the fibrous stalks of the tree-ferns found in the rain-forest communities. From observations in N temperate countries it might be expected

that the genera involved would be *Mycena* and *Marasmius*, and their close relatives; this is indeed the case but several species unexpectedly to Europeans are poriod and many bioluminescent. With *Pleurotus lampas (= ?Omphalotus)* these species produce an eerie glow at night in the rain-forest or in the laboratory if colonised wood is brought back for study.

One wonders whether this phenomenon is to attract night flying insects or the fruiting bodies are just 'burning off' excess energy. Species of *Marasmius* s. lato) are abundant but few can be given names; only further research will unravel their identity. Superficially many resemble those depicted in the beautiful plates T. Petch prepared from his Ceylon collections of *Marasmius* (1948). If their role is as important as their British counterparts, they will be one of the biggest groups of litter recycling organisms in the flora. Observing the bleached areas of leaves on the forest floor offers no evidence to suggest the contrary! Before leaving these small tricholomataceous agarics it should be noted that the relationship between algae and agarics so familiar to those who collect in the arctic or mountain regions, i.e. *Omphalina*, is also found in Australia. *O. chromacea* quite commonly fruits with a lichen, *Botryodina vulgaris*, on banks in eucalypt forest indicating the relationship may be found world wide and in range of ecological niches.

The genera *Russula* and *Lactarius*, although easily distinguished from other agaric-genera in Australia, are composed of species which are difficult or impossible to run-down in the meagre literature available. The fruiting bodies encountered look superfically similar to those we all see in N. America and European woods but they differ in structure of the cap, spore-colour etc. No annulate species have been recorded, or seen although if an earlier link with Madagscar, where such taxa do occur, might be hypothesised some could be hoped for, perhaps in the north of Australia in Northern Queensland with its flora similar to that of New Guinea; indeed annulate taxa have been encoutered (Simpson, pers. comm.) in New Guinea in recent years.

Australia is a haven for those who enjoy the vagaries of nature for there they will find scores of species of Tobacco pouches, 'Secotiaceae', some described by the early workers e.g. Rodway of Hobart, but many, many more undescribed. An assortment of taxa are distributed throughout the continent and can often be found fruiting in huge troops, e.g. species of *Octaviania, Zelleromyces* etc. Lyre birds in search for tit-bits turn over many square feet of forest floor; these are excellent hunting grounds for upturned hypogeous fungi. But there is very good evidence that kangaroos and other marsupials dig up the fruiting bodies of these semi-hypogeous fungi for food in much the same way as Jim Trappe has described for placental rodents in North America (Parbery, pers. comm.; Malajczuk, pers. comm.).

One such hypogeous fungus originally described from California as *Secotium tenuipes* and later placed in the genus *Setchelliogaster*, was named after its discoverer Setchell, the famous American algologist. It grows with eucalypts on West Coast US College campuses and surely is Australian in origin. In fact herbarium material has been located in Cleland's collections in Adelaide amongst his unidentified collections and since then it has been found in nature by J. Warcup (pers. comm.).

Conclusion

It should be considered significant in an understanding of the evolution of the basidiomycetes to find in the rain-forests of Australia so many species of the Coral fungi in the genus *Ramaria*. This genus shows interconnecting relationships with several other groups of larger fungi, particularly to the 'Pig ears' (*Gomphus*), but, it can also be argued, related on the one hand with *Gymnopilus* and on the other

with Paxillaceae and the boletes. Another branch of ramarioid Corals may link with *Cantharellus* and its relatives and so possibly to the *Tricholomataceae;* food for thought?

Australia is a fascinating country indeed with a flora and fauna advertised rightly as mysterious and stimulating, and to which can be added now an exciting mycoflora. It is hoped that people returning home to see relatives in Europe, or visiting the N temperates world whilst on leave from educational institutes will find this account of interest. Alas it only shows that the differences between the fungal floras of their original homelands and Australia are greater than the differences between Australasia and South America. Australia is indeed part of the South Pacific basin and because of the basically European links budding agaricologists should cast their eyes across and around the Pacific area for the answer to some of the questions the Australian agarics might pose. A first attempt has been offered by Horak (1983), but the future holds even more surprises.

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Appendix: Species Mentioned.

Agaricus arvensis Schaeff.: Fries.
A. Campestris L.: Fries.
Amanita muscaria (L.: Fr.) Hooker.
A. nauseosa (Wakefield) Reid.
Boletellus ananiceps (Berk.) Sing.

B. ananus (Curt.) Murr.
'Boletopsis' iceterinus Pat. & Bak.
Chlorophyllum molybdites (Meyer: Fr.) Massee.
Cortinarius radicatus Clel.
Cyptotrama asprata (Berk. & Curt.) Singer.
Descolea recedens (Cooke & Massee) Singer.
Gymnopilus junonius (Fr.) P. D. Orton (= *G. spectabilis* (Fr.) Singer).
G. pampeanus (Speg.) Singer
Hebeloma porphyrosporum R. Mre.
H. radicosum (Bull.: Fr.) Ricken
H. sarcophyllum (Peck) Sacc.
Lactarius deliciosus (L.: Fr.) S. F. Gray
Lepiota dolicaula (B. & Br.) Pegler & Rayner.
Leucocoprinus birnbaumii (Corda) Singer.
L. cinnamomea Clel.
L. fuliginosa Clel.
Omphalina chromacea Clel.
Paxillus involutus Batsch: Fr.) Fr.
Phaeogyroporus portentosus (B. & Br.) McNabb.
Phallus hadriani Vent. ex Pers.
Pleurotus lampus Berk.
Polyporus mylittae Cooke & Massee.
P. tumulosus Cooke.
Psilocybe cubensis (Earle) Singer.
Pulveroboletus ravenelii (Berk. & Curt.) Murrill.
Rhizopogon luteolus Fr. & Nordh.
Rozites autraliensis Clel. & Cheel *Cortinarius australiensis* (C. & C.) Horak.
Setchelliogaster tenuipes (Setchell) Pouzar.
Suillus granulatus L.: Fr.
S. grevillei (Klotzsch) Singer.
S. luteus L.: Fr.
Volvariella speciosa (Fr.: Fr.) Singer.

A Range Extension of the Snail *Glacidorbis hedleyi* Iredale 1943 in Victoria

BY ANDREW BOULTON* and BRIAN J. SMITH†

Abstract

Glacidorbis hedleyi Iredale 1943 is recorded from four sites on two intermittent streams; the Werribee River and the Lerderderg River in southern Central Victoria. This represents a westward extension of its range and is the first record of *G. hedleyi* from intermittent habitats in Victoria.

Glacidorbis hedleyi Iredale 1943 was first recorded from a depth of 35 ft. (10.7m) in Blue Lake, Mt. Kosciusko, N.S.W. (Iredale, 1943). Further specimens have been collected from slightly acidic waters of alpine and forest streams, bogs and mountain lakes (Smith, 1978, 1979). These waters are cold for most of the year and are usually subject to snow every winter (Smith, 1979). The distribution has subsequently been recorded by Smith and Kershaw (1979) as "Great Dividing Range of eastern Victoria and southern N.S.W." (Fig. 1).

The distributions of two further species, *G. pedderi* (Smith 1973) from south-western Tasmania and *G. magallanicus* Meier-Brook and Smith 1975 from southern Chile, have been used to provide evidence for zoogeographical relationships between south-eastern Australia, Tasmania and South America (Meier-Brook and Smith, 1975). Another species, *G. pawpela* Smith 1979, was described from Great Lake in the central highlands of Tasmania (Smith, 1979) and a further, unknown species of *Glacidorbis* has been recorded from Lake Sorell (Fulton, 1983). Additional support for a Gondwanic distribution of *Glacidorbis* was provided by Bunn and Stoddart (1983) who described

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a new species, *G. occidentalis,* from permanent and temporary streams in southwestern Australia. They cited Buonaiuto (1982) who reported a fossil species of *Glacidorbis* from Middle Miocene deposits in the Strzelecki Desert, Central Australia, suggesting that the past distribution of *Glacidorbis* was much more extensive than is now the case.

Numerous adults and juveniles of *G. hedleyi* were collected from shallow pools and riffles of the upper reaches of two intermittent rivers, the Werribee River and Lerderderg River. This extends the known distribution of *G. hedleyi* westward into another catchment (Fig. 1). Previous brief surveys of the lower Werribee River (Macmillan, 1977) and the Lerderderg River (Morison, 1977) did not record *G. hedleyi.*

Both rivers rise on the southern edge of the Great Dividing Range and flow southeast towards Port Phillip Bay. Their flow regimes are extremely variable with peak discharge, and often flooding, in spring, falling in summer when flow may cease completely for 2-3 months. The collecting sites are on third order streams (*sensu* Strahler, 1957) flowing through dry sclerophyll forest dominated by Manna Gum *(Eucalyptus viminalis)* and, less abundantly, Messmate *(E. obliqua),* Narrow-leaved Peppermint *(E. radiata)* and Blackwood *(Acacia melanoxylon).* Some physical and chemical features of the streams at the collecting sites are presented in Table 1.

The snails were collected from riffles and pools using a suction sampler with a 300 µm mesh net (Boulton, 1985). All material was fixed in 5% formalin before being preserved in 70% ethanol. Voucher specimens from the two rivers are lodged in the Museum of Victoria as follows: F52152 "Fireplace Ford", Lerderderg River, 3.8 km WNW of Blackwood, 37°31' S, 144°06' E, A.J. Boulton, 16.8.83, 10 specimens; and, F52153 "Werribee Picnic Spot", Werribee River, 11.5 km NNW of Ballan, 37°29' S, 144°10' E, A.J. Boulton, 11.10.83, 5 specimens.

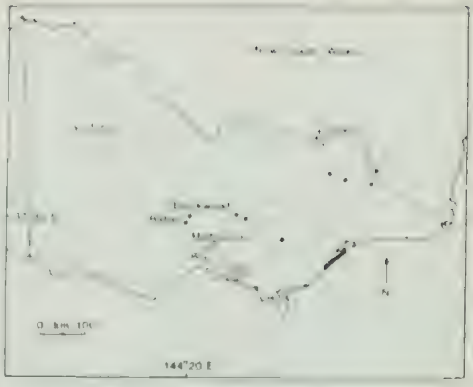

Fig. 1. Map of distribution of *Glacidorbis hedleyi* in Victoria. The eastern records are from Smith (1978, 1979).

During the study period (May 1982 to March 1984), the upstream site on the Werribee River, 15 km NNW of Ballan, remained dry during the drought of 1982-83 and water flowed in it for only seven months in 1983-84. The downstream site, 11.5 km NNW of Ballan, experienced flow for five months in 1982, dried out completely in summer 1982-83 and, after eight-and-a-half months of flow in 1983, dried to pools early in 1984. The Lerderderg River, 3.8 km and 4.8 km WNW of Blackwood, flowed for seven months in 1982 before drying out completely at both sites. Flow resumed in early May 1983 and continued beyond the end of the study.

Glacidorbis hedleyi occurred in greatest numbers (up to approx. 180 individuals per m^2) in riffles in the Lerderderg River. Fewer specimens were collected in riffles in the Werribee River at the downstream site and only occasionally from pools at the Lerderderg sites and the riffle at the upstream site on the Werribee River. Adults and juveniles were often collected suggesting the persistence of viable populations.

The snail appears to be able to withstand successfully the intermittent flow regime and a wide range of water temperature, pH, dissolved oxygen and conductivity (Table 1). Animals collected from

Site		Temperature (°C)	pH	D.O. (ppm.)	Conductivity (µS/cm)
Werribee River, 15 km NNW of Ballan (riffle).	$\bar{x}$	9.7	6.8	10.9	72.3
	range	6-21	6.1-7.3	5.4-15.0	53-110
	(n)	(17)	(17)	(13)	(17)
Werribee River, 11.5 km NNW of Ballan (riffle).	$\bar{x}$	9.0	6.7	10.5	130.7
	range	2-21	5.2-7.6	6.0-15.0	67-225
	(n)	(27)	(24)	(27)	(27)
Lerderderg River, 3.8 km WNW of Blackwood (pool).	$\bar{x}$	10.2	6.5	7.3	84.6
	range	2.5-19	5.2-7.3	1.2-15.0	51-175
	(n)	(43)	(37)	(43)	(42)
Lerderderg River, 3.8 km WNW of Blackwood (riffle).	$\bar{x}$	9.5	6.5	7.6	77.4
	range	2.5-15.0	4.8-7.3	2.2-15.0	51-115
	(n)	(34)	(28)	(34)	(34)
Lerderderg River, 4.8 km WNW of Blackwood (pool)	$\bar{x}$	10.4	6.6	7.7	88.0
	range	2-20	5.3-7.4	1.4-15.0	48-210
	(n)	(40)	(33)	(40)	(40)
Lerderderg River, 4.8 km WNW of Blackwood (riffle)	$\bar{x}$	9.3	6.5	10.2	75.7
	range	2-19	5.5-7.5	2.0-15.0	48-100
	(n)	(33)	(26)	(33)	(33)

Table 1. Some physical features of the habitats from which *G. hedleyi* was collected ($\bar{x}$ mean, (n) number of observations). Data were collected from May 1982 to March 1984. Records include measurements taken from drying puddles in the riffle.

the Acheron River near Warburton were mainly concentrated in heavy build-ups of leaf debris (MacMillan, 1975; Meier-Brook and Smith, 1975). *G. hedleyi* in the Werribee and Lerderderg Rivers did not appear to show special preference for areas of leaf accumulation and were uncommon in quantitative samples that contained much leaf debris. No specimens were collected from leaf pack colonization experiments conducted in the Lerderderg River in 1984, although other gastropods were recorded (Boulton, unpublished data) suggesting that this species does not show any preference for areas of leaf accumulation.

The average pH values of the streams are slightly acidic (Table 1) although they equal or exceed the upper values measured by Bunn and Stoddart (1983) in three streams where *G. occidentalis* was found. After cessation of flow, most pools accumulate large amounts of decaying leaf matter and the water becomes discoloured with *Eucalyptus* leachate. The pH in these pools is often quite low, but *G. hedleyi* is not as common there as in the riffle habitats, even when the riffle is dry.

Dissolved oxygen levels are usually at saturation although they fall markedly in the pools when flow ceases and the pools begin to dry out (Table 1). Summer water temperatures undoubtedly exceed those of the localities where *G. hedleyi* has been collected formerly although winter values are probably comparable. Average water temperatures recorded in this study are cooler than those reported by Bunn and Stoddart (1983) for *G. occidentalis* habitats in Western Australia. It is of in-

terest to note that *G. occidentalis* was also recorded from an intermittent stream and presumably can withstand desiccation. *G. hedleyi* probably over-summers in moist micro-habitats (e.g. under rocks, leaf litter) in the dry stream bed rather than seeking pools for refugia. Closing the operculum further reduces water loss. Viviparity has been observed in *G. hedleyi* (Smith, 1979) and this may also be of adaptive significance to its tolerance of a temporary flow regime.

The molluscan fauna associated with *G. hedleyi* in the Werribee and Lerderderg Rivers is similar to that recorded with *Glacidorbis* in other localities sharing species in the Sphaeriidae and the Hydrobiidae. Freshwater limpets of the genus *Ferrissia* and a planorbid snail are also present. Details of this fauna with further ecological data will be published separately.

The discovery of *G. hedleyi* in a separate catchment west of Melbourne provides a link with the western species and supports the hypothesis of a Gondwanic relictual distribution of the genus *Glacidorbis*. In view of the species' tolerance of flow intermittency, we would not be surprised to record *Glacidorbis* further west of the present range or in South Australia.

Acknowledgements

We would like to thank P.S. Lake and D. Morton for useful criticism of the manuscript.

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The Shoreline Strip

BY EDMUND D. GILL*

When Rachel Carson published her book "Silent Spring", saying that all living things would die out if not cared for, a group of staff at the then National Museum of Victoria discussed this unusual book. They thought the thesis a little overdone (as may be expected of an enthusiast), but that it contained an important truth — conservation is a vital necessity. However, we thought that it would take about 50 years (two generations) for this view to be accepted. We were wrong. The idea of conservation took off like a rocket. Why this is so, is not altogether clear.

Popular Thinking and Scientific Discovery

As a result of conservation being taken up so rapidly, popular thinking has run ahead of scientific discovery. It is demanded that we conserve the natural world, but the fact is that we do not know how to do it. To conserve intelligently, we need to understand the ecosystem — how the species of living things are related to one other and to the world of inanimate things. But we know the life histories of a limited number of species, and how they interact we are only beginning to discover. We cannot predict with the certainty of real knowledge what will be the effect of many things we do.

Coastal Problems

For example, it is not yet agreed how a shore platform evolves, and the processes of beach formation are still being investigated. Thus we have outer harbours half full of sand, and piers half destroyed. For 130 years theory after theory has been advanced as to why Warrnambool Harbour filled with sand. It has always been assumed that there is one sand system. The key to the problem is known to be that there are two sand systems. Until we understand the ecosystem we will not know for sure what to do to conserve the coast.

Human Thinking

We humans are air breathers, so the interface between air and water appears to be the boundary of an ecosystem. But this is not so. We are too impressed with the air/water interface because we can so easily drown. The edge of the water is not the edge of the beach ecosystem because the sand passes freely to and fro across that boundary. Waves throw up sand and also comb it back. Onshore winds blow sand into dunes. Offshore winds blow sand back. In the surf zone the breaking waves lift sand off the seafloor, and then currents may move it away. There are rip currents, tidal currents and windshear currents.

Boundaries of the Coast Ecosystem

The coastal ecosystem has its seaward boundary where wave base contacts the seafloor, i.e. where the waves break, the start of the surf zone. It is commonly thought that the air is limited by the surface of the sea, but in fact the breaking waves mix it with the sea water. That is one reason why the nearshore waters are so productive; they are highly oxygenated. The landward boundary of the ecosystem is the landward edge of the sea sand. This may be the sandfall edge of a dune, the edge of a blowout, or a flat sandspread (Fig. 1). These sediments are all a function of shoreline processes.

For this interacting ecosystem of surf zone, beach and backbeach sands I have given the name Shoreline Strip (Gill, 1982). This is a useful concept. When the conservation of coastal dunes or beaches is being considered, it is necessary to think in terms of the processes of the whole shoreline strip — the complete ecosystem.

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A.M. Gill photo

Fig. 1. Aerial view of the shoreline strip in Venus Bay, Gippsland, Victoria. The shoreline strip reaches from the seaward edge of the surf zone to the landward edge of the backbeach sand showing dark in the photograph.

Coastal Compartments

So far we have considered a cross-section of the shoreline strip, but to what distance does this system extend along the shore? An example is taken from S.W. Victoria. In Portland Bay light grey limesand (calcarenite) lines the Bay from Portland to the Eumerella River (Gill, 1979), but from there to Cape Reamur at the east limit of the bay are cliffs of light brown consolidated calcarenite. These two coastal divisions with their distinctive properties are called *compartments.* Thus there is a compartment with light grey sand to the Eumerella River, and a compartment from there to Cape Reamur with light brown sand. Following the cutoff achieved by Cape Reamur, there is a compartment with basalt and lowdunes of light grey sand from there to Tower Hill beach, followed by a very long one reaching all the way to Cape Otway.

From Tower Hill beach to Lake Gillear east of Warrnambool are cliffs that yield light brown sand. From there to Cape Otway there is no source of light brown calcarenite, so that type of sand piled on Cape Otway (Bird, 1984) has moved with the easterly longshore drift from the Warrnambool district.

Shoreline Strip on Rocky Coasts

On rocky coasts the seaward boundary of the shoreline strip is of course still the outer edge of the surf zone, but the inner edge is the margin of the splash zone on the cliffs. This is marked by the upper limit of occurrence of the supratidal mollusc *Littorina,* and by the limit of splash-produced features such as honeycomb weathering of the coastal type. For example, at Mount Defiance on the Otway coast, a scalloped line is formed by the upper limit of *Littorina.* The height of splash reaching the cliff depends on free access provided by shore platform channels, or on the other hand the shelter provided by high rock outcrops.

Review

The endless belt of waves ever modifies that delicate ribbon of sand we call the beach, from which sand comes and goes. Tides come and go; waves mount high or flatten. From the outer edge of the surf zone to the landward edge of coastal sand, the whole system constantly pulses with change, yet is one well-defined ecosystem — the shoreline strip.

On rocky coasts, sand may collect on shore platforms or form sand clouds in frantic waves. Rocks may be hurled ashore or ground to sand in shore platform channels. Change and interchange are constant. The dynamic well-oxygenated waters and the rocks (or sand, the softest rock) ever interact in the shoreline strip — the zone of ocean energy transfer.

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A Field Companion to Australian Fungi

BY B.A. FUHRER, The Five Mile Press, Melbourne (1985), 162 pp. Price $16.95.

Macroscopic fungi provide the amateur and professional botanist with a barely explored kingdom. An absence of any definitive guide to this kingdom seems to deter rather than encourage further exploration. In fact our state of knowledge of Australia's fungal flora may be compared to the state of knowledge of Australia's vascular plants existing when Mueller first arrived in Australia!

The challenge provided by such appalling ignorance should be a stimulus to disciplined amateurs and professionals alike. Few have taken up this challenge. Whilst Dr Jim Willis's main contribution has been to the vascular flora, his field guide 'Victorian toadstools and mushrooms' provided the only reference for amateurs from 1941 until the last decade. Certainly this was not Dr Willis's intention. Mr. Gordon Beaton is a Victorian amateur who hasn't been deterred by the absence of a field guide. Through correspondence with overseas experts and careful research Mr. Beaton has become a world authority on his chosen group. (Gasteroid Basidiomycetes.) Such lasting contributions are often the unexpected reward of mycological enthusiasts.

Mr. Bruce Fuhrer is an amateur mycologist but his contribution is highly professional and durable. *A Field Companion to Australian Fungi* is the single most useful field guide to appear for Australia and will be indispensable to naturalists. The photographs have astonishing depth of field and are marvellously composed to demonstrate both the diagnostic features and the charm of his subjects. Clarity and colour are reproduced faithfully. The 128 species selected for illustration demonstrate a valuable cross-section of commonly encountered species as well as those more exotic species liable to arouse curiosity. The inevitable bias towards Victoria can only suit Victorian naturalists.

The collecting of herbarium specimens as vouchers for photographs has ensured that the species names are as accurate as the taxonomy allows, and that the material is available for future study as taxonomic revisions take place. The brief Introduction and Reference list provide a starting point for beginners, however annotations to the references and the addition of more important revisions would be valuable. A key at least to genera, is a major omission although many amateurs are unreasonably loathe to use such refinements.

An excellent, tested key may be found in another of Bruce's publications, *A field guide to the common genera of gilled fungi in Australia* by F.M. Cole, B.A. Fuhrer and A.A. Holland, Inkata 1978. More detailed keys requiring microscopic characters are available in *Australian mushrooms and toadstools* by A.E. Wood, NSW Univ. 1983, and in *Common Australian fungi* by A.M. Young, NSW Univ. 1982.

I remember Dr Willis suggesting that if his botanical career was beginning today the frontiers of mycology would provide his first interest. Perhaps Bruce's guide will be a catalyst to stimulate the future production of a definitive handbook by one of today's students.

As a postscript, the quality of Bruce's photography is well displayed in posters prepared from a number of illustrations in the field guide. The posters are available from the Naturalists Book Sales Officer.

— Stephen Forbes

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Subscription rates for 1986 are to be increased. This is unfortunately necessary because the rates are based on the production and mailing costs of *The Victorian Naturalist* which have continued to escalate, to which is added a membership fee of $3.00 which is applicable to both partners in a joint membership. A higher rate applies for Metropolitan members, who have the opportunity of attending meetings, using the library and so on.

The new subscription levels show an increase of $2.00 on all categories except Junior membership which remains at $3.00 and Joint Metropolitan membership which is to be increased by $1.00. The cover price of *The Victorian Naturalist* will increase to $3.00.

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Ian Faithfull,
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Observations on Disjunct Populations of *Eucalyptus aggregata* in Victoria and N.S.W., with Notes on the Status of *E. rodwayi*

BY DIANNE SIMMONS*

Introduction

Eucalyptus aggregata Deane and Maiden is a small to medium sized tree distributed mainly through the central and southern tablelands of N.S.W. (Brooker and Kleinig, 1983). In Victoria the only occurrence of the species is a small area around Woodend (Carolan, 1964), where there are several hundred trees some 500km from the main N.S.W. populations (Fig. 1). In view of the long distance from the major area of occurrence, the Woodend population is likely to have been genetically isolated for a long time. Differentiation following genetic isolation is frequently suggested as a first step in speciation (Stace, 1980) and this paper aims to investigate the extent to which the disjunct Woodend population has diverged from core N.S.W. populations. The status of the morphologically similar Tasmanian species *E. rodwayi* Baker and Smith is also considered briefly.

E. aggregata

Five trees of *E. aggregata* were sampled from Woodend, Vic. and from Hartley Vale, N.S.W.. Nine morphological characters were measured on ten leaves and fruits from each tree (internode length, leaf blade length, leaf blade breadth, distance from the base of the leaf to widest point, peduncle length, fruit diameter, fruit length and pedicel length), and the volatile leaf oils were extracted by steam distillation and analyzed by Gas-Liquid Chromatography, using methods described in Simmons and Parsons (1976). The two populations were compared over all characters and tested for significant differences using a t-test (Sokal and Rohlf, 1969).

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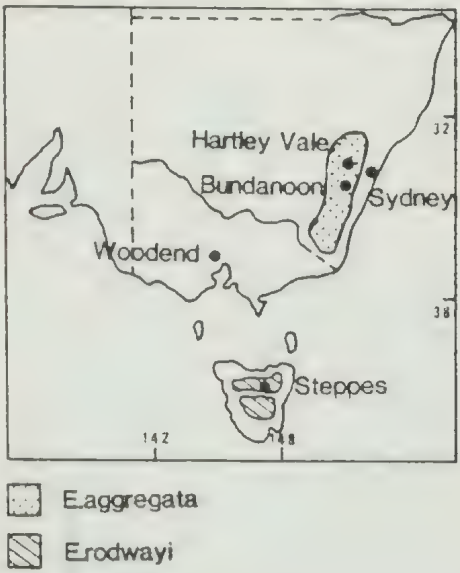

Fig. 1 Distribution of *E. aggregata* and *E. rodwayi* (following Brooker and Kleinig 1983) and the location of sample sites.

The populations from Woodend and Hartley Vale were remarkably similar over both morphological and chemical characters (Table 1). There were no significant differences between populations in any morphological character ($P<0.05$), except for a minor difference in fruit diameter. Similarly, from over 65 oil components the only significant differences in the volatile oil components of the two populations ($P<0.05$) occurred in minor components present in very small amounts.

A number of eucalypts are reported to have large disjunctions between populations which appear to be morphologically indistinguishable (Chippendale and Wolf, 1981; Pryor and Johnson, 1971). However, considerable geographic variation in morphology and leaf oils has been described in a number of species which have been examined in detail (Johnstone,

1984; Simmons, 1974). It is therefore of considerable interest that the two populations from Woodend and Hartley Vale are virtually identical.

It is unlikely that the Woodend population has arisen through modification of its range following European settlement, or through long distance dispersal, as eucalypt seeds have no special adaptations for dispersal and travel only short distances (Pryor, 1976). In some areas, a number of species show similar disjunc-

Table 1. Comparison of some morphological characters and leaf oil components of populations of *E. aggregata* and *E. rodwayi* .

Character (in mm)	*E. aggregata* Woodend, Vic.	*E. aggregata* Hartley Vale, N.S.W.	*E. rodwayi* Steppes, Tas.
Internode length	13 (11–14)	13 (11–14)	12 (9–13)
Petiole length	12 (7–17)	12 (10–13)	11 (10–13)
Leaf blade length	122 (96–136)	116 (99–129)	103 (90–120)
Leaf blade breadth	21 (18–23)	21 (17–25)	23 (20–25)
Peduncle length	4.2 (3.7–4.9)	3.8 (3.5–4.1)	5.7 (3.8–7.9)*
Pedicel length	1.7 (1.3–2.4)	1.4 (1.2–1.7)	1.9 (1.6–2.3)
Fruit diameter	4.7 (4.4–4.9)	4.3 (4.2–4.4)†	4.9 (4.5–5.1)
Fruit length	3.1 (2.6–3.3)	3.0 (2.7–3.3)	3.7 (3.3–4.1)*
Oil Component (%)			
1 Isovaleraldehyde	10.8 (6.3–16.4)	17.1 (11.6–25.1)	1.0 (0.8–1.1)**
2 —Pinene	4.1 (1.5–6.2)	10.0 (0.9–20.6)	6.5 (5.2–7.5)
6 Limonene	2.8 (1.5–3.9)	3.2 (1.0–4.6)	1.3 (0.8–2.0)
7 Cineole	3.6 (1.5–5.9)	3.8 (2.5–4.8)	80.2 (78.0–82.0)***
8 —Terpinene	1.9 (0.5–3.9)	0.3 (0.3–0.4)	0.4 (0.3–0.5)
9 p-cymene	3.5 (0.8–6.7)	0.7 (0.3–1.0)	0.5 (0.3–0.6)
26 Unknown	3.4 (1.1–5.0)	2.5 (1.1–4.1)	3.3 (2.0–3.9)
27 Unknown	6.2 (3.1–15.5)	3.3 (2.1–5.5)	1.8 (1.3–2.6)
30 Geranyl acetate	2.0 (1.1–2.8)	1.1 (0.8–1.9)	tr. (tr.–0.03)**
31 Nerol	3.4 (1.0–7.7)	1.6 (1.0–2.1)	0.6 (0.4–0.8)**
36 Unknown	6.4 (4.1–9.5)	5.5 (2.6–9.3)	0.1 (tr.–0.2)**
40A Unknown	15.0 (9.8–20.9)	11.1 (7.7–15.0)	0.3 (0.1–0.4)***
43 Unknown	0.8 (0.5–1.0)	2.1 (0.6–2.2)	0.2 (0.1–0.3)***
44 Unknown	0.9 (0.4–1.0)	0.9 (0.4–1.6)	0.2 (0.1–0.3)**
51 Methyl eudesmate	3.2 (1.6–6.4)	4.7 (3.5–5.8)	n.d.
52 —Phenylethylphenyl acetate	24.8 (14.5–30.9)	26.4 (15.4–41.2)	n.d.

Ranges of the 5 trees sampled are given in parentheses
n.d. not detected, less than 0.005% if present
tr. trace, less than 0.03%
Only those oil components present at greater than 1% in at least one population are listed.
The only significant differences are between populations of *E. aggregata* († $P<0.05$) and between populations of *E. aggregata* and *E. rodwayi* (* $P<0.05$, ** $P<0.01$, *** $P<0.001$).

tions and this suggests that disjunct occurrences may be remnants of a past continuous distribution (Parsons, 1973). Cain (1944) believes that major disjunctions result from the contraction of a species range from a previously wider distribution, due to climatic, or some other change. Cain also suggests that two characteristics of senescent or "old" species are morphological uniformity and general confinement to extreme habitats.

E. aggregata is generally restricted to cold, wet sites, where frosts are common and often severe (Carolan, 1964; Hall *et al.*, 1970). Low temperatures and frost frequency may be important factors explaining the present distribution of *E. aggregata* as a relic population in Victoria. The morphological uniformity and geographic distribution of *E. aggregata* suggest that during a cooler wet period in the past, the species had a wider distribution, which has contracted following a general amelioration of climate, leaving behind the relic Woodend population in a small area prone to heavy frosts virtually year round (Foley, 1945). Eucalypts have existed at least since the late Tertiary (Lange, 1982) and there have been a number of cold periods during the past 700,000 years (Singh, Kershaw and Clark, 1981). The last cold period occurred between 30, 000 and 10,000 BP, while climate has been similar to the present since 10,000 BP (Costin, 1971). *E. aggregata* is morphologically, chemically and presumably genetically uniform over its range and it is likely that the Woodend population has remained genetically stable for a long time. In a study of the phylogenetic relationships (based on seedling morphology) in the informal series *Ovatae,* Ladiges *et al.,* (1984) concluded that *E. aggregata* was one of the most primitive taxa, and that its present day distribution is a relict pattern. A study of disjunct populations of *E. kitsoniana* using allozyme variation also showed very low variability between populations (Fripp, 1982).

E. aggregata X *ovata hybrids*

E. ovata Labill. occurs at both Woodend and Hartley Vale. At Hartley Vale,

Table 2. Comparison of some morphological characters and leaf oil components for *E. aggregata, E. ovata* and a putative hybrid in N.S.W..

Character (in mm)	*E. aggregata**		Hybrid*	*E. ovata* †	
Bark Type		Rough	Gum		Gum
Leaf blade breadth	21	(17–24)	29	46	(43–50)
Leaf blade length	116	(99–129)	120	159	(148–188)
Peduncle length	3.8	(3.4–4.1)	7.9	10.3	(7.1–13.4)
Fruit diameter	4.3	(4.2–4.4)	6.0	6.8	(5.8–7.2)
Fruit length	3.0	(2.7–3.3)	4.5	5.5	(5.1–6.4)
Pedicel length	1.4	(1.2–1.7)	1.7	2.2	(1.3–2.9)
Oil component (%)					
1 Isovaleraldehyde	17.1	(11.6–25.1)	3.5	0.4	(.11–.68)
7 Cineole	3.8	(2.5–4.8)	74.6	71.2	(64.5–76.4)
51 Methyl eudesmate	4.7	(3.5–5.8)	0.1	n.d.	
52 —Phenylethylphenyl	26.4	(15.4–41.2)	0.6	n.d.	

* Sampled at Hartley Vale, † Sampled at Bundanoon, N.S.W. Ranges of the 5 trees sampled are given in parentheses n.d. not detected, less than 0.005% if present.

one tree which appeared morphologically intermediate between *E. ovata* and *E. aggregata* was also sampled. Further examination of morphological characters and leaf oils, and comparison with *E. ovata* (sampled from Bundanoon, N.S.W.), indicated that it was intermediate in many characters (see Table 2). Intermediate morphology and leaf oils, and recombination of characters from supposed parental species have often been used as evidence of hybridization (Simmons and Parsons 1976; Stace, 1980), and this tree is presumed to be an *E. aggregata* X *ovata* hybrid. Further checking of several *E. aggregata* stands at Woodend revealed at least one tree which appeared morphologically intermediate between *E. aggregata* and *E. ovata* (leaf oils were not analyzed). This tree was similar to the Hartley Vale putative hybrid (see Table 3, Fig. 2), and it is presumably also an *E. aggregata* X *ovata* hybrid. In a study of the geographic variation in the leaf oils and morphology of *E. ovata* (involving about 180 trees), no other trees similar to the putative hybrids were observed (Simmons, 1974). Comparison of the supposed hybrids must take into account the variation in *E. ovata* between the sites.

These observations suggest that *E. aggregata* has been genetically stable for a long period although at both localities a limited amount of hybridization with *E. ovata* has occurred. Although hybrids are often sterile, in *Eucalyptus*, they are frequently fertile and are also associated with site disturbance (Pryor, 1976). Both the putative hybrids in this study are found on disturbed sites. The Woodend hybrid is located on the railway reserve, while the Hartley Vale hybrid is found on a disturbed roadside, and therefore hybridization between these species may be a relatively recent phenomenon.

E. rodwayi

E. rodwayi is a Tasmanian species previously included under *E. aggregata* Deane and Maiden (Hall *et al.*, 1970, Ladiges *et al.*, 1984). Five trees from Steppes, Tasmania were sampled and morphological characters measured and leaf oils extracted as for *E. aggregata* (Table 1). The only significant differences between the species in any morphological characters were in slightly longer fruits and peduncles in *E. rodwayi* ($P<0.05$). *E. rodwayi* also has thicker leaves than *E. aggregata*, though this difference was not quantified.

The leaf oils of *E. aggregata* and *E. rodwayi* appear to be qualitatively different. Chemical forms have been reported for a number of *Eucalyptus* species, however they were not observed within *E. aggregata* or *E. rodwayi* in this study (Simmons, 1974). The leaf oil of *E. aggregata* has a very distinctive composition, and contains components not frequently found in *Eucalyptus* such as methyl eudesmate and β-phenylethylphenylacetate (Hellyer *et al.*, 1966). *E. rodwayi* has oils high in cineole and more typical of large number of eucalypts. Given the qualitative differences

Table 3. Comparison of some morphological characters for *E. aggregata*, *E. ovata* and putative hybrid from Woodend, Vic..

Character (in mm.)	*E. aggregata*	Hybrid	*E. ovata*
Bark Type	Rough	Gum	Gum
Petiole length	12 (7–15)	12	130 (107–151)
Leaf blade length	122 (96–134)	128	22 (20–27)
Fruit diameter	4.7 (4.4–4.9)	5.6	6.2 (5.8–6.9)
Fruit length	3.1 (2.6–3.3)	3.5	5.8 (5.2–6.9)

Ranges of the 5 trees sampled are given in parentheses.

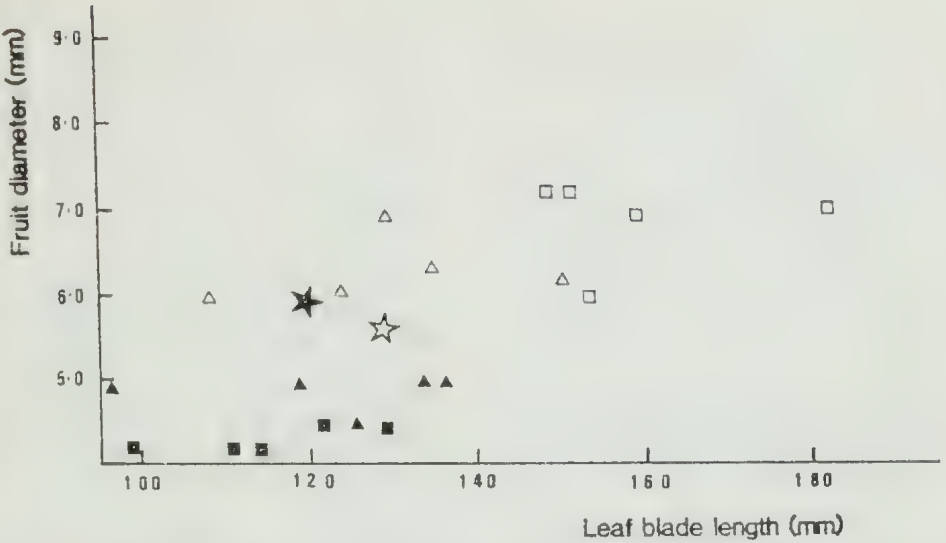

Fig. 2 Scatter diagram between fruit diameter and leaf blade length for *E. aggregata*, Woodend (▲), *E. aggregata*, Hartley Vale (■), *E. ovata*, Woodend (△), *E. ovata*, Bundanoon (□), putative hybrid, Woodend (☆) and putative hybrid, Hartley Vale (★).

between the taxa and the distinctive nature of *E. aggregata* oil, it is not likely that the differences are due to chemical forms in a single species (Simmons, 1974).

It is generally inappropriate to erect new species on the basis of oil composition. However, the distribution of *E. rodwayi* in Tasmania, small differences in morphology of adult trees, and greater differences in seedling morphology (Ladiges *et al.*, 1984) suggest that *E. rodwayi* should be accepted as a species. *E. aggregata* and *E. rodwayi* may be regarded as vicariads (Cain, 1944; Stace, 1980). *E. aggregata* and *E. rodwayi* were initally regarded as the same species, and more recently have been placed in the same superspecies (Pryor and Johnson. 1971) suggesting a close relationship between the two. Ladiges *et al.* (1984) however, found that in all their analyses, *E. aggregata* and *E. rodwayi* were consistently separated. This study supports their hypothesis that in spite of their morphological similarity, *E. aggregata* and *E. rodwayi* may not be closely related. Pryor and Johnson (1971) report a number of *Eucalyptus* species pairs which are similarly difficult to separate on herbarium material, but which cause little confusion in the field due to their allopatric distributions.

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F.N.C.V. Excursion to Cann River, January, 1985

Twenty members of the F.N.C.V. travelled to Cann River on 18 January, 1985, for the usual summer excursion, and those who were there in 1971 were keen to see what changes could be found in the flora and fauna of East Gippsland.

We did not see signs of the fire which was still burning in the Croajingalong National Park, but along all roads were blackened trunks and epicormic growth of eucalypts, regenerating after serious bushfires in 1983. Banksias flourished, and in places, small grass trees *(Xanthorrhoea resinosa)* stood in ordered rows, like headstones in a cemetery, and the orange plumes of *Calomeria amaranthoides* flamed in the valleys. Mrs Joan Walker, who drove some of us to photograph these, told us that only one home had been lost in the fires, as the inhabitants had stayed within the houses to protect them, and she was adamant that this was the safest course.

Although we did not have the opportunity to visit Errinundra Plateau, the tall eucalypts around Cann River and in the Lind National Park delighted the coastal and Western Victorians. Blue gums *(E. bicostata)*, coast grey box *(E. bosistoana)*, silvertop ash *(E. sieberi)* and peppermint *(E. elata)* towered over lesser trees. Southern mahogany *(E. botryoides)* and several stringybarks were also prominent.

The excursion was nearly four weeks later in the year than the 1971 trip, and the vegetation showed this. We looked in vain for the duck and tongue orchids which had been flowering freely; the only orchid that was in flower wherever we went was the hyacinth *(Dipodium punctatus)*. In the valleys, small trees and shrubs were smothered by climbers, though these were not in flower: water-vine *(Cissus hypoglauca)*, wonga vine *(Pandorea pandorana)*, *Smilax australis*, wombat berry *(Eustrephus latifolius)* and *Clematis aristata*. Isolated patches of rainforest, intersected by small creeks, showed ferns of all kinds: tree ferns *(Dicksonia antarctica)* and, among others, fan fern *(Stitcherus lobatus)* and ground fern *(Culcita dubia)*. These patches also showed the bird observers some of the more unusual species — the leaden flycatcher, whipbird and black-faced monarch.

Plants in full flower along the forest roads included *Senecio* sp., *Scaevola ramosissima*, *Dampiera stricta*, milkwort

(Comesperma calymega) and two species of *Dianella,* while the dainty white and gold of the shrubs *Bursaria spinosa* and *Tristania laurina* showed in the understorey.

One day's destination was Mallacoota, and as before, Mr. Allan Peisley accompanied us, as did our old friend Mr. Archie May. Here we met again the saw banksia *(B. serrata),* coast banksia *(B. integrifolia)* and bloodwood *(E. gummifera)* and large trees of *Angophora floribunda* were flowering profusely. Allan Peisley showed us, at Betka, five of the six species of the mistletoe to be found here—coast mistletoe *(Amyema celastroides)* is parasitic on the banksias and is found only as far west as Lakes Entrance, while we saw again the golden mistletoe *(Notothixos subaureus)* on its fellow the long-flowered mistletoe *(Dendrophthoe glabrescens).* Creeping mistletoe *(Muellerina eucalyptoides)* we found on the melaleucas *(M. ericifolia)* and the fifth was the interesting jointed mistletoe, *(Korthalsella japonica).* While crossing the road, some were rewarded by the sight of an azure kingfisher, darting across in front of us. Driving out to the aerodrome, we saw isolated examples of horned orchid *(Orthoceras strictum)* and tongue orchid *(Cryptostylis subulata)* and while examining a grove of *Persoonia juniperina,* we were entertained by a grey fantail which swooped fearlessly round our heads, gathering the flies that were sheltering on our backs from the chill wind. After lunch, we inspected the long concrete bunker which had been built as a possible air-raid shelter for service personnel during the 1939-45 war.

Also as in 1971, we visited Mr. Archie May's house to see his insect collections and two Gippsland water dragons *(Physignathus lesuerii howittii)* living happily among ferns in his shade house. Near the house, we were delighted to see a number of robins — flame, scarlet and yellow robins — and yellow faced honeyeaters, all together in a small area. Then, some walked, some were transported in car-loads by Mr. May, to see a plant of butterfly orchid *(Sarcochilus australis)* growing on a tree.

We also visited Point Hicks, walking up to the lighthouse through an avenue of *Banksia integrifolia,* and those who had not visited before, climbed the lighthouse stairs for an interesting demonstration. Stops on the way home enabled us to examine the *Scaevola, Comesperma,* (laced together by busy *Araneus* spiders) *Persoonia* and *Stypandra glauca.*

Back to the coast next day, we visited Cape Conran, finding quite different rock formations at East and West Cape and Point Ricardo. Banksias flourished on the sand-dunes, where New Holland honeyeaters and yellow-tailed black cockatoos were seen. Our bus driver found an attractive green sea star *(Patiriella calcar),* which we photographed before returning it to its rock pool.

The last day held a real highlight, as most of the party walked down to Cabbage-Palm Creek to see the tall *Livistona australis* in their mosquito-haunted gully, where rufous fantails flaunted glowing patches of colour.

However, for the bird-o's, the magical place was at Cann River itself. On the right bank of the river a levee bank has been raised, and a track along this gives access to the grazing properties beyond. We travelled this track morning and evening and never failed to return with a "new" bird on the list, bringing the total for the trip to approximately one hundred. The track led through thickets of willows and acacias, and between them, tall trees in open patches, and finally, an open paddock. We looked each day for our favourites — two brown goshawks, probably just full-grown, which watched us in turn with fierce, bright eyes. At this time, no chicks were found in nests, but several birds were in immature plumage, including a white-

faced heron, flame and yellow robins, pallid, brush and fan-tailed cuckoos, cicada bird, and a sacred kingfisher which perched on the motel clothes-hoist. Flocks of needle-tails were seen on several occasions, and several species of honeyeaters, thornbills, parrots and robins.

The most exciting moment occurred when the bird-o's led the way into a swampy area along the Cann Valley Highway. Two large kangaroos were first disturbed by Dorothy, then a red-bellied snake *(Pseudechis porphyriacus).* Lil stood admiring its beauty and graceful movement, until she realised that she was directly in its escape path! "You don't worry about the blacks," said a local, "it's the tigers you have to watch". However, we had a most successful excursion, with perfect weather — and no tigers.

—Lilian B. Kirk

F.N.C.V. Botany Group Report for Year 1984-1985

During the year the group maintained its activities of monthly meetings at the Herbarium and monthly field excursions. The group also contributed to the F.N.C.V. Nature Show held in October with an exhibit, one section of which was based on bush fire recovery, and another on threatened species of plants.

Meetings had an average attendance of 30, (including visitors) and, apart from Members' Nights, the meetings were addressed by speakers who in some cases were our members and in others were visitors. Subjects included botanical information on both local and overseas areas of interest; for example, Alpine Plants of South-Eastern Australia, French Island, Alpine Areas of Europe, Study Courses in Field Centres of the U.K. Other talks were concerned with studies of specific botanical families, namely Orchidaceae, Epacridaceae and fungi.

Excursions attracted an average of 21 members and visitors. These covered a number of locations near to Melbourne, the furthest being Lake Mountain and Buxton in February and March when the days were longer. The Botany Group's continuing interest in Courtney Road, South Belgrave was maintained with an excursion to this area in Spring. In June our search for fungi at Fernshaw was not well rewarded, the Winter having been rather dry up to that time. Our visit to Riddell in October proved very interesting and opened up the possibility of further work in this area in association with the Macedon Range Conservation Society. The development of contacts such as this could be an important activity for the future as it involves the Botany Group in field observations which contribute to the collective knowledge of a specific area and so strengthens the on-going work of conservationists.

W. ROCKE,
President, 1984.

Day Group F.N.C.V. Annual Report 1984

Chairman Mr Alf Fairhall. Vice Chairman Mr Jack Wilson who we regret passed away and his place was taken by Mr Ian Gillespie. Mrs. Gillespie retired as secretary and Mr Dan McInnes was to act as secretary.

Outings for the Day Group were as follows:

Feb.: Hawthorn-Yarra River Walk.
Mar.: Hampton — Sandringham.
April: Studley Park. Yarra Park.
May: Metropolitan Fire Brigade Museum.
June: Oakleigh Technical School. Horticultural School.
July: World Trade Centre and Collins St. West.

August: South Melbourne Historical Buildings.
Sept.: Bellbird Dell — Nunawading.
Oct.: La Trobe University and Wild Life Reserve.
Nov.: Cherry Lake — Altona.

Average attendance at outings: 15 members.

The Group is trying to arrange outings suitable for public transport.

D. E. McInnes.
Sect. Day Group F.N.C.V.

F.N.C.V. — Geology Group Annual Report for 1984

Well, here we are again, another 12 months gone, with, I believe more excitement (and hard work) ahead. This year saw attendances increase (by 12.7%) yet again. This apparent renewed interest in Geology augers well for the group, and mankind as a whole.

This year presented almost the full scope of our subject, e.g., Plate Tectonics (Afar Triangle), Minerals Industry (Oil Shale, and the What and Which way of the Mining Industry), Archaeology (Pompeii), History (Geologists of old), Palaeontology (History of Fish), Ancient Cultures (Rock Paintings Cape York) and Approaching Geology (Reading and Understanding the Geology of an Area).

There was the groups', participation in the October F.N.C.V. "Nature Show", and mention of our activities in the Register of Community Events, October Edition (Page 6). An indirect result of the Nature Show was the further enhancement of inter-group activities, with a visit planned in 1985 to the Basin Field Naturalists.

In the area of excursions, the group continued on from 1983 with two (2) more inter-group excursions; (1) Return to Wabonga Falls, and (2) Geology of Wan garatta, both with the N.E. F.N.C. Closer to home, saw us visit a Trilobite site (un der extremely wet, but happy conditions) near Whittlesea.

One of our members, Paddy Duanne, has requested our involvement regarding an Excursion Field-Book (Education Dept., Curriculum Branch), which means 1985 may well become The Year of the Fieldwork.

Lastly, I take this opportunity to thank everyone who has assisted me throughout 1984, as few will realise how busy it has been for me.

GRAHAM LOVE,
Chairperson.

Mammal Survey Group — F.N.C.V. Annual Report 1984/85

A busy year for the Group which saw it take on three new long-term surveys for Government departments, viz. a mammal and herpetofauna survey of Braeside Metropolitan Park (MMBW); and two surveys for the National Parks Service — a terrestrial vertebrate survey of the Big Desert Wilderness, and a search for the Brush-tailed Rock-Wallaby in the Grampians. Concerning the latter the Group has so far made two forays to likely sites and although there have not been any sightings of the animal, exciting discoveries of fresh scats leads us to believe we are **hot** on the trail! All three surveys will continue into 1985 and perhaps 1986.

The Group recently received a grant of $1000 from the Department of Conservation, Forests and Lands and will use the money to buy new equipment, and help

alleviate the cost of the Rock-Wallaby surveys. Participation in Group activities (camps and meetings) has remained at a fairly constant level. The attendance at our extended camps has been particularly high (40 in the Big Desert on last Melbourne Cup weekend).

15th April, 1985

LANCE WILLIAMS,
Hon. Secretary.

Microscopical Group Annual Report 1984-1985

The groups membership remained stable except for Mr H. Bishop who moved to N.S.W. and Mr D. Wentworth who died in November after a short illness. Des and his father, a past chairman, had an association with the group extending over 50 years.

Again there was an increase in visitors, particularly to the lecture on "Training Laboratory Technicians" with a demonstration of video through the microscope. Arising from this demonstration Dr Hamond submitted a proposal which was approved by Council on the 29th November, 1984, and referred back to Dr Hamond to prepare a grant application for acquisition of a video camera and monitor screen.

Speakers for the year were the Chairman Mr U. Bates, Mr J. Dawes, Mr D. Wentworth, Mr D. McInnes, Mr R. D. Graham, Professor A. C. Bolton, Dr E. Peters, Mr R. Murray and Dr Hamond.

One of our members, Mr Dan McInnes, was awarded a book on Mammals in recognition of his work as Book Sales Officer for many years, which Dan then presented to the F.N.C.V. library.

Dr Hamond, Mr Dawes and Mr Graham attended the lecture at the Laby Theatre, by Professor A. C. Bolton on "Early Optics in Melbourne" a report on this lecture was submitted at the meeting No. 325 on the 17th October, 1984.

E. C. GRAHAM,
Hon. Secretary
Microscopical Group of the F.N.C.V.
14th April, 1985

FIELD NATURALISTS CLUB OF VICTORIA

Reports of recent activities

General Meeting Monday, 13th May

A presentation of a FNCV badge engraved with the words "30 years service" and a silver platter inscribed "For outstanding service. FNCV 1985" was made to Miss Marie Allender in recognition of the many years of dedicated service she has given the club. Mr. Dan McInnes gave details of her FNCV record.

A member of the club since 1947, Marie was elected to council and to the position of Excursion Secretary in 1954 and has held these positions ever since.

She has arranged a total of 457 excursions over the last 30 years and was secretary of the Botany group between 1957 and 1963.

The Marie Allender Excursion Fund which she manages so well, now earns the Club $1,800 per year in interest.

The presidents report for 1984-85 was read by the retiring president Miss Wendy Clark. Some of the major points of the report (printed in May/June Naturalist) were;

— the successful Nature show held in October 1984

— receipt of grants totalling $1650 from the Department of Conservation, Forests and Lands and a grant of $1500 from the Department of Management and Budget to help with publication costs of the Victorian Naturalist.

— the 110th anniversary of the Microscopical Society of Victoria
— the awarding of the Australian Natural History Medallion to Mr. Kevin Keneally
— the awarding of seven honorary memberships. Thanks went to the outgoing Council and office-bearers for their hard work.

Miss Clark regretted the necessity of her retirement as President and wished the Club well in the future.

The Treasurer's report was then given by the treasurer, Mr. Noel Disken. (Balance sheets for 1984 printed in March/April Naturalist). Once again the club saw a fairly difficult year financially although it benefited considerably from interest from accounts and profit from book sales ($ 1,973). Due to increasing costs subscription rates to the Victorian Naturalist will have to increase for 1986.

Election of Office-bearers and Council Members. Officers Elected: President: Dr. Brian Smith, Hon. Secretary: Mr Ian Faithfull, Hon. Treasurer: Mr Noel Disken, Editorial Committee: Miss Joan Phillips, Mr Lance Williams, Miss Diana McClellan, Mr Peter Lawson and Mr Russell Thomson, Librarian: Mrs Sheila Houghton, Excursion Secretary: Miss Marie Allender, Programme Secretary: Miss Christine Shankly, Offices vacant: Vice President, Assist. Secretary, Assist. Treasurer, Assist. Librarian.

Council Members. In addition to the President, Dr. Brian Smith and Immediate Past President, Miss Wendy Clark, the following people were elected to council: Mrs Sheila Houghton, Miss Margaret Potter, Miss Christine Shankly, Mr Noel Disken, Mr Ian Faithfull, Mrs Helen Stanford, Miss Marie Allender and Miss Betty Somerville.
Other Positions: Conservation Council of Victoria Representatives: Mr Lance Williams, Mr Ian Faithfull and Mr Michael McBain.
Club Reporter: Miss Christine Shankly

Dr. Brian Smith then took the chair for the Presidential address on the subject of Krakatoa. Dr. Smith took part in a scientific expedition to the Krakataus in Indonesia 101 years after the massive volcanic explosion of 1883 blew away half the Island of Krakatoa. The explosion and subsequent tidal wave caused many thousands of deaths on the coasts of Java and Sumatra. The sound of the explosion was heard thousands of miles away and for years afterwards beautiful sunsets were seen around the world due to the huge quantity of debris which had been thrown up into the stratosphere.

The islands, now a National Park, provide a great opportunity for scientists to look at progressive recolonization as all plant and animal life on the islands was destroyed by the explosion and new, sterile land is still being produced by continuing eruptions.

The purpose of the expedition was to collect data about the current state of recolonization of the islands and to look at the main recruitment areas of Java and Sumatra and compare the results with those of previous expeditions.

Dr. Smith described the methods used for recording animals and collecting data and gave some of their results. These included about 80 species of birds, 4 or 5 bats, many reptiles including the first record of *Typhlops*, a blind snake, for the island, many insects, spiders and 16 species of snails. The number of species on the islands is still increasing.

Animals reach the island usually either by flying there or being carried over on the winds if they are small enough, by being washed ashore or by the activities of the local people.

The death of a Life Member of the F.N.C.V., Mr. Ernest Busby was noted with regret. Members stood and observed silence in his memory.

The Cosstick Reserve at Maryborough has been refenced with rabbit-proof fencing after the previous fencing had been destroyed by bushfires. Thanks were

extended to the Maryborough F.N.C. for the work they put in to re-fence the reserve.

EXHIBITS

— Foraminifera under microscopes.
— A Wattle Goat Moth pupal casing from Napier Park near Strathmore.
- A book produced by the Society for Growing Australian Plants about a 10 acre property entitled "Karalla".
— Pumice found on a beach at Wilson's Promontory which had originated 8000 miles away in the South Sandwich Islands as a result of a volcanic eruption in the 1960's.
— Unusual fused fruit of *Eucalyptus st. johnii.*
— A case of beetles, mostly Cucujiformia.

General Meeting
Monday, 17th June

The deaths of two FNCV members were announced with regret and members stood for a moments silence in their memory. They were Mr. David Lee who had been the Club secretary for a number of years and foundation member of the Conservation Council of Victoria and Miss Mervyn Davis who had been a member of the FNCV since 1948.

Honorary Memberships were awarded to Mr. Geoff Shepherd and Mr. Brian Williams. Mr. Bill Middleton spoke about his friends Mr. Sheperd and Mr. Williams and the time they had spent together at the Creswick Forestry School in the 1940s and of their interest in plants and conservation.

A third honorary membership was awarded to Mr. Neil Burrows of Launceston who was unable to attend the meeting.

The speaker of the evening was Mr. Peter Jackson, a Research Officer with the Arthur Rylah Institute who spoke on "Native Freshwater Fishes of Victoria."

Australia has fewer species of freshwater fish than any other continent with the exception of Antarctica. It has only about 130 species compared with some 2000 in South America and 1400 in Africa. This lack of diversity in our fish fauna is due largely to the fact that Australia is such a dry continent and has really only one major river system, the Murray-Darling.

Australia separated from the other land masses before the major groups of freshwater fish had evolved. Most of our species have evolved relatively recently from marine ancestors and many must return to the sea or estuarine waters for part of their life cycle.

Mr. Jackson spoke about the 5 major drainage systems in Victoria and gave examples of life histories of some of the species found within them.

Since European settlement there has been a dramatic decline in the distribution and abundance of some of our native species due to a number of factors including competition from introduced species and changes in the environment brought about by "river improvement" works and impoundments.

In the past most of the research done on fish has been on the introduced species and little is known about most of the native species. Mr. Jackson stressed the importance of research to gather information about the life cycles and habitat requirements of native fish so that their survival can be assured in the future by proper management strategies. He detailed research he has been undertaking into the biology of the River Blackfish, *Gadopsis marmoratus*, and also spoke about the work he is currently involved with to develop legislation to ensure protection of the stream environment for all species.

Exhibits

Rock sections under the microscopes (some under plane polarized light):
— Quartzite from Keilor.
— Basalt from a laneway pitcher.
— Amphibolite from Western Australia.

(Continued from inside front cover)

Thursday 10th October. "Plant Collecting in Australia" Stephen Forbes.

Geology Group — First Wednesday

Wednesday 7th August — Mineral Identification Night.

Wednesday 4th September. To be announced.

Wednesday 2nd October. To be announced.

Mammal Survey Group — First Tuesday.

Tuesday 3rd September " Group Survey Projects" B. Lobert.

Tuesday 1st October. To be announced.

Microscopy Group — Third Wednesday.

Wednesday 21st August "Plant Sections by C. Nance" Urwin Bates.

Wednesday 18th September "Chemical Stains and Mountant — Historical" J. Davies.

Wednesday 16th October. "Marine Life and the Microscope" Dan McInnes.

GROUP EXCURSIONS

All FNCV members and visitors are invited to attend Group Excursions

Botany Group

Saturday, 27th July. Sherbrooke Forest.

Saturday 28th September. Kinglake.

Friday 25th — Sunday 27th October. The Grampians.

Mammal Survey Group

Saturday 10th — Sunday 11th August. The Grampians.

Saturday 5th — Sunday 6th October. To be announced.

Geology Group

Sunday, 11th August. Volcanic eruption points around Melbourne. Leader: Graham Love.

— Limbergite from Macedon Quarry.
— Porphoritic Basalt from Korkuperrimal Creek.
— Granite.

A map of areas in the Mallee which are to be cleared showing their vegetation cover.

Nature Notes

Several reports of large flocks of Seagulls seen flying north over Broadmeadows in the morning and south again in the evening. At Rosebud the birds can be seen flying westwards in the direction of Mud Island in the evening.

Currawongs have returned to Blackburn Lake for the winter.

The F.N.C.V. council would like opinions from members on the suggestion at the July meeting by Marie Allender for a change in the Naturalist if members approved and it proved feasible. The suggestion is to re-arrange the contents to provide:
10 standard Naturalists issued monthly from February to November. ? 16 pages.
2 Special supplements per year. ? 52 pages.
The standard Naturalists would have cheaper printing and paper and would contain Club news, coming events, simple articles, book reviews, excursion and group reports, nature notes, etc.

The supplement would include major articles, surveys and items requiring expensive production. Many articles would be suitable for either type of Naturalist. The suggested number of pages totals the same as printed last year but this could be varied.

The standard Naturalist would not be as attractive in appearance but combined with the supplement would cover all the material we normally publish and it seems possible this could cost much less than the club paid last year.

This proposal would require careful consideration before a change was made so PLEASE send your ideas to the secretary and also let him know if you could help with typing or any editorial work.

Field Naturalists Club of Victoria

In which is incorporated the Microscopical Society of Victoria

Established 1880

Registered Office: FNCV, c - National Herbarium, Birdwood Avenue, South Yarra, 3141.

OBJECTS: To stimulate interest in natural history and to preserve and protect Australian fauna and flora.
Members include beginners as well as experienced naturalists.

Patron:
His Excellency Rear Admiral SIR BRIAN S. MURRAY, KCMG, AO.

Key Office-Bearers 1984-1985

President
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Hon. Secretary: Mr. I. FAITHFULL, 83 Easey Street, Collingwood, 3066 (419 9908 A.H.)

Hon. Assistant Secretary: Mr. A. THIES, 25 Davies Street, East Malvern, 3145 (25 6012)

Hon. Treasurer: Mr. NOEL DISKEN, 24 Mayston St., Hawthorn East, 3123 (82 3471 A.H.)

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Editorial Material: Forward to Ms J. U. PHILLIPS, C/- Museum of Victoria, Russell St., Melbourne, 3000.

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Day Group: Mr. D. E. McINNES, 129 Waverley Road, East Malvern, 3145 (211 2427)

Geology: Miss HELEN BARTOSZEWICZ, 16 Euroa Avenue, Nth. Sunshine, 3020 (311 5106 A.H.)

Mammal Survey: Mr LANCE WILLIAMS, 29 Erica Crescent, Heathmont, 3135 (879 1962 A.H.)

Microscopical: Mrs ELSIE GRAHAM, 147 Broadway, Reservoir, 3073 (469 2509)

MEMBERSHIP

Membership of the F.N.C.V. is open to any person interested in natural history. The *Victorian Naturalist* is distributed free to all members, the club's reference and lending library is available and other activities are indicated in reports set out in the several preceding pages of this magazine.

Subscription rates for 1985

Metropolitan Members (03 area code)	$18.00
Joint Metropolitan Members	$21.00
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Joint Country/Interstate/Retired Members	$18.00
Student (full-time)	$12.00
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Subscription to Victorian Naturalist	$16.00
Overseas Subscription to Victorian Naturalist	$22.00
Individual Journals	$2.50

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The Victorian Naturalist

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FNCV DIARY OF COMING EVENTS

GENERAL MEETINGS

Monday, 14th October, 8.00 p.m.
Dr. Neil Hallam. "The Biology of Macquarie Island"

Monday, 11th November, 8.00 p.m.
Medallion Presentation: Mr. Jack Hyett. "Before the Medallion."

Monday, 9th December, 8.00 p.m.
Mr. Michael McBain. "The Victorian Underworld: A Natural History of Caves"

New Members — May /June 1985 General Meetings

Metropolitan

Mrs. Kay Fairley, 26 St. Georges Road, Toorak 3142.
Mr. Ian J. Frankcombe, May Road, Officer 3809.
Ms. Liz James, 63 Filbert St., Sth. Caulfield, 3162.
Miss Kerryn Maynes, 135 Lightwood Road, Noble Park 3174.
Miss Daphne Pearson, Amesbury, C/- P.O. Beveridge 3673.
Mr. Norman J. Plever, 9/1 Harfield Ct., W. Footscray 3012
Mr. Patrick G. Shaw, 30 Lumeah Road, Caulfield 3162.
Mr. Michael H. Ward, 14 Galeka Street, Coburg 3058.
Mr. Meyer Eidelson, 21 Docker Street, Elwood 3184.

Country

Mr. John Mawson, Box 211, Ararat 3377.

Joint

Mr. Tom Griffiths and Ms. Libby Robin, 72 Fenwick Street, Nth. Carlton 3054.

Student

Mr. Robert Tony Vajna, 1 Turner St., Croydon 3136.

FNCV EXCURSIONS

Sunday, 3rd November. Brisbane Ranges. This exursion will include a wildflower walk with one of the rangers leaving the Anakie Gorge picnic area about 11.30 a.m. Coach will leave Batman Ave., at 9.30 a.m. Fare: $10.00. Bring a picnic lunch.

Sunday, 1st December. Healesville Sanctuary. This exursion will be by public transport. Catch the Belgrave train from Flinders St., at 9.22 a.m. to Ringwood. Change to Lilydale train which connects with a bus to the Sanctuary, leaving Lilydale station at 10.35 a.m. and arriving at the Sanctuary at 11.20 a.m. The return bus leaves Healesville at 5 p.m. and connects with 6.10 p.m. Melbourne train. A day travel card at $4.00 or $1.70 concession will cover travel, admission is extra.

Sunday, 12th – Sunday, 19th January. Tasmania. Please note day of departure is Sunday not Saturday as in last Naturalist. The plane departs Melbourne 8.55 a.m. for Hobart where B. and B. accommodation has been booked at Hadley's Hotel for the week. Day exursions are planned to Mt. Wellington, Bruny Island, Russel Falls, HARTZ Mountain National Park, Risdon, Maria Island and a half day tour of Richmond before our return on Sunday, 19th January. Cost $450.00. A $200.00 deposit is required when booking and the balance by Tuesday, 12th November. Bookings with the excursion secretary, Marie Allender.

GROUP EXCURSIONS

All FNCV members and visitors are invited to attend Group Excursions.

Botany Group

Saturday, 28th September, Kinglake.
Friday, 25th — Sunday, 27th October. The Grampians.
Saturday, 23rd November. "Rushes, Sedges and Grasses" Leader: David Albrecht.

Geology Group

Sunday, 6th October. The Peninsula area.
Sunday, 10th November. Belgrave. Leader: Graham Love.

Mammal Survey Group

Saturday, 5th — Sunday, 6th October. Upper Big River.

Saturday 2nd — Tuesday, 5th November. Big Desert Wilderness.

Thursday, 26th December, 1985 — Wednesday, 1st January, 1986. The Grampians.

GROUP MEETINGS

All FNCV members and visitors are invited to attend Group Meetings

Day Group — Third Thursday.

Thursday, 17th October. Zoological Gardens. Meet at Royal Park Railway Station at 11.30 a.m. Leader: Joan Miller, 836 2681.
Thursday, 21st November. Yarra River Park. Meet at south-west corner of Princes Bridge at 11.30 a.m. Leader: Audrey Pittard, 836 7725.
No excursions in December or January.
At the National Herbarium, Birdwood Ave., South Yarra at 8.00 p.m.

Botany Group — Second Thursday

Thursday, 10th October. "Plant Collecting in Australia". Mr. Stephen Forbes.

Thursday, 14th November. "Victorian Terrestrial Orchids". Patrick Ward and "Introduction to Rushes, Sedges and Grasses". David Albrecht.

Thursday, 12th December. Annual Meeting and Members' Night.

(Continued inside back cover)

The Victorian Naturalist

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Cover Illustration: The Mourning Skink, *Egernia coventryi.* Storr. Photograph: Peter Robertson.

May/June and July/August 1985 issues were incorrectly numbered as Vol. 103 instead of Vol. 102

The Occurrence of the Mourning Skink, *Egernia coventryi* Storr, in Saltmarsh in Westernport Bay, Victoria

By Martin Schulz*

Introduction

The Mourning Skink (*Egernia coventryi* Storr) is an uncommon medium-sized skink (maximum snout-vent length 13 cm). It has a disjunct distribution through southern Victoria and extending into south-eastern South Australia (Cogger, *et al*, 1983). This lizard has been recorded inhabiting densely vegetated cane grass or heathy swamps (Rawlinson, 1974; Emison *et al*, 1975; Dorward, 1976; Smales, 1981 and Macfarlane *et al*, in prep.). The dominant plant species in these swamps are Common Reed (*Phragmites australis*), saw sedges (*Gahnia* species, Swamp Paperbark (*Melaleuca ericifolia*), Scented Paperbark (*M. squarrosa*),. Woolly Tea-tree (*Leptospermum lanigerum*), and tussock grasses (*Poa* species) (Robertson, 1980). A population also occurs in a closed sedgeland community dominated by Roperush (*Leptocarpus tenax*) and sedges (*Lepidosperma* species) (pers obs.). *E. coventryi* appears restricted to these habitats and has not been recorded ranging into adjacent vegetation communities (Smales, 1981 and Macfarland *et al*, in prep.).

E. convertyi was previously regarded as very rare, probably as a result of its restricted habitat preferences and of the limited collecting techniques employed. This paper describes the species' occurrence in tidally-influenced saltmarsh on the fringe of Westernport Bay, in central Victoria.

Methods

In autumn 1981 saltmarsh areas fringing Westernport Bay were surveyed for reptiles (Fig. 1). Individuals of *E. coventryi* were located under tidal debris and dumped refuse within and on the periphery of saltmarsh. Sites at which *E. coventryi* was recorded were revisited in May 1985 and an additional site was located. At these sites habitat information was recorded, in particular: the dominant plant species in a 10 m^2 area centred on the site; % cover of vegetation, bare ground and surface water at high low tides; the degree of tidal-influence at the site (eg. whether regularly or infrequently flooded); and the distance from the inland edge of the saltmarsh. Other lizard species occurring in sympatry were recorded. Visits were made to two localities in an attempt to locate *E. coventryi* during high tide when the lizard's refuge sites were flooded.

Results

a. Site Details

E. coventryi was recorded from four localities within saltmarsh fringing Westernport Bay (Fig. 1). The characteristics of each of these sites is summarised in Table 1.

1. Tortoise Head, French Island.

A population occurred in saltmarsh between Tortoise Head and the "mainland" of French Island (Fig. 2). Here the lizard was found under driftwood. One subpopulation occurred in Shrubby Glasswort (*Sclerostiga arbuscula*) and Beaded Glasswort (*Sarcocornia quinqueflora*) dominated saltmarsh covered by water during each high tide cycle. These lizards were frequently found sheltering under driftwood with several species of crabs, *Helograpsus haswellianus* and *Brachynotus spinosus;* the air-breathing gastropod *Salinator solida;* and marine isopods. A second subpopulation frequented an area of saltmarsh approximately 150 m from the first subpopulation. The saltmarsh was similarly dominated by *S. arbuscula* and *S. quinqueflora* but only flooded during spring high tides. A maximum count of eight individuals was made at these sites in March 1981.

*Mountain Forest Research Station, Sherbrooke, Vic. 3789.

Fig. 1. Areas of saltmarsh and mangroves (represented by shaded area) in Westernport Bay (from Shapiro, 1975) and the four *E. coventryi* sites.

2. Crib Point

Two lizards were found 10 m inland of the White Mangrove (*Avicennia marina*) belt in saltmarsh dominated by *S. arbuscula* and Creeping Brookweed (*Samolus repens*) approximately two kilometres north of Crib Point. This site was flooded during each high tide cycle. Both lizards were found under logs together with a large number of the crab *H. haswellianus* and the gastropods *S. solida* and *Ophicardelus ornatus.*

3. Tooradin airstrip

A maximum of seven individuals were found under dumped timber and rusting metal in *S. arbuscula* and *S. quinqueflora* -dominated saltmarsh, one kilometre west of Tooradin airstrip. The area is under little tidal-influence, being flooded only during spring high tides. However, the whole area was overlain by a maximum of 4 cm of freshwater (May 1985). One lizard was found 200 m from the main population (designated subpopulation 2 in Table 1) in a (halophytic closed herbfield dominated by *S. quinqueflora* (Fig. 3).

4. Bunyip River (Main Drain) Mouth

A large population occurred in saltmarsh and adjacent *Stipa stipoides* tussock grassland. The saltmarsh, dominated by *S. arbuscula* and *S. quinqueflora,* is only flooded during spring high tides and when the Bunyip River is in flood. This population appears to have undergone a marked decline with a maximum of eighteen lizards found in April 1981

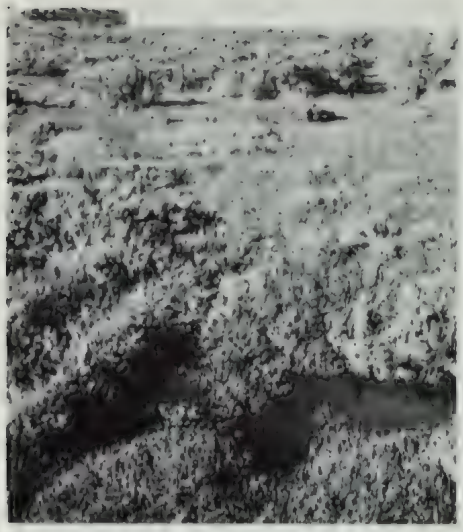

Fig. 2. Site occupied by subpopulation 2 in the saltmarsh at Tortoise Head, French Island.

Fig. 3. Site occupied by the saltmarsh west of Tooradin airstrip. The foreground dominated by *Sclerostiga arbuscula* was inhabited by the main population. One individual was found in the flooded *Sarcocornia quinqueflora* herbfield in the centre of the photograph.

and none were located in May 1985 despite extensive searching.

b. Reaction to Tidal Flooding

At the sites regularly flooded high tide no direct observation were made on the evasive action taken by *E. convetryi.* This was because of the turbidity of incoming water and the difficulty of observing the lizard sheltering under driftwood. During high tide when known shelter sites were flooded no lizards could be located.

c. Reaction to Disturbance

E. coventryi was observed to bask on logs during warm sunny weather in May 1985. On one occasion a Black-shouldered Kite (*Elanus notatus*) flew low over a basking lizard. The skink immediately dropped into the surrounding thick mat of *S. quinqueflora.* The kite has been recorded taking skinks (Bakker-Gabb 1984) and is a potential predator of the species.

In an attempt to escape capture one individual dived into 3 cm deep brackish water and hid amongst *S. quinqueflora* branchlets. It remained there for at least five minutes.

d. Sympatric Species

No other medium-sized skinks were found together with this species in the saltmarsh. In other vegetation communities in Victoria it has been recorded together with the Black Rock Skink (*Egernia saxatilis*) and the Southern Water Skink (*Sphenomorphus tympanum*) (Smales 1981 and Macfarlane *et al* in prep.).

Two small skink species, Common Grass Skink (*Leiolopisma entrecasteauxii*) and Metallic Skink (*Leiolopisma metallica*), occurred at all the sites from which *E. coventryi* was recorded (with the exception of *L. metallica* from Site 2).

Discussion

E. coventryi, previously regarded as very rare, has been found in a number of localities in recent years. The frequency of recording this lizard has increased due to knowledge of its preferred habitat, behaviour and the relative ease with which

:t can be captured in Elliott traps. The occurrence of *E. coventryi* in saltmarsh has not previously been recorded and poses some interesting ecological and behavioural questions.

E. coventryi was found to occur in saltmarsh only in areas with an abundance of driftwood. Smales (1981) and Macfarlane *et al* (in prep), found this lizard predominantly in areas with numerous logs in freshwater habitats. In the saltmarsh the lizard was not found away from such sites despite extensive searching. Robertson (1980) found *E. coventryi* sheltered in burrows excavated by itself or utilizing the burrows of the yabby, *Engaeus sternalis*. This may have been a strategy adopted by the lizard in areas of the saltmarsh where the water table was below the substrate surface. However, on saturated substrate where burrows (of undetermined species) were completely flooded this was considered unlikely. At the Crib Point site where numerous burrows occurred the lizard showed no interest in escaping down these flooded burrows when chased. Similarly when the lizards were partially pushed into the flooded burrows and released their immediate reaction was to emerge.

The question remains as to how the lizard copes with flooding during high tide. Clearly it is able to live in an aquatic environment as evidenced by its distinct habitat preferences and the escape mechanism of diving into water and remaining submerged until danger has passed. It does not appear to remain under driftwood that becomes submerged on an incoming high tide. The lizard may move to higher ground above the flooding

	SITES					
	Tortoise Head		Crib Point	Tooradin Airstrip		Bunyip River Mouth
Subpopulation	1	2		1	2	
Flooding Regime	Every HT	Spring HT only	Every HT	Heavy rain Spring HT only		Spring HT only When Bunyip R. in flood
Distance from inland edge saltmarsh (m)	500	500	250	80	80	50-155
Vegetation Cover (%)	80	100	70	80	50	75
Dominant plant species (>10% cover)						
Sclerostiga arbuscula	50	40	30	30	—	40
Sarcocornia quinqueflora	20	35	—	40	60	50
Suaeda australis	30	10	10	—	—	—
Samolus repens	—	—	20	10	—	—
Rhagodia baccata	—	10	—	—	—	—
% surface water at low tide	15	0	5	50	90	80
Depth of water at low tide (cm)	<5	0	< 5	<5	<5	< 5
Depth of water at high tide (cm)*	<100	0	< 100	<5	<5	<5
Maximum number of *E. conventryi*	5	4	2	7	1	18

Table 1. Summary of site information from *E. coventryi* saltmarsh sites, Westernport Bay, Victoria.
* = not including spring high tides
HT = High Tide.

	Degree of Flooding	March 1981	May 1981	August 1981	January 1981	May 1985	June 1985
Subpopulation 1	regular	5	1	0	3	1	0
Subpopulation 2	irregular	3	2	2	2	4	3

Table 2. Numbers of *E. coventryi* in the two subpopulations present in saltmarsh at Tortoise Head at different times of the year.

level. However, Robertson (1980) suggested that the home range of *E. coventryi* may be only about 40 m with a maximum dispersal distance of 200 m in juveniles. At both sites of regular tidal-flooding the distance to higher ground was greater than the maximum dispersal distance therefore unlikely to be travelled by the lizard. At all sites regularly flooded (and all except one irregularly flooded sites) the shrub *S. arbuscula* was prevalent, growing to maximum height of almost 2 m. It suggested that if the lizards do take evasive action from the tide they may climb to the tops of *S. arbuscula* shrubs. The uppermost branches were not covered by water even during spring high tides. The lizard would appear suited to this as it has particularly sharp gripping claws. It also actively searches for food in small shrubs and grass tussocks (Robertson 1980).

Robertson (1980) suggested that *E. coventryi* was not active between mid-April and early September. Active individuals were observed in sunny conditions in May 1985. However, during the colder months when activity is low it is unlikely that the lizard would be able to maintain evasive action from flooding, particularly during the nocturnal cycle. Therefore an exodus from these regularly flooded sites may be expected during the winter months. From the little information available this would appear to be the case (Table 2). To test whether individuals hibernated inside large drift logs at these regularly flooded sites logs were split open at the Tortoise Head site. No lizards were located. While at the irregularly flooded site at Tortoise Head two individuals were located in logs in a torpid state.

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SCORPIONS WANTED

Would anyone knowing exact locations of the burrowing scorpion *Urodacus armatus* (a yellowish reddish brown scorpion, adults approximately 7 cm long, burrows 15 to 35 deep) please contact Mr. J. Fell, C/o Zoology Department, La Trobe University, Bundoora, 3083.

Visions of Nature: *Wild Life*, 1938-1954

By Libby Robin*

Introduction

The years 1938 to 1954, the years of the magazine *Wild Life*, were transitional in the popular collective consciousness of Australian fauna and flora. As a child of the fifties, I am one of a generation brought up on *Blinky Bill* (1939), *Snugglepot and Cuddlepie* (1946), and the John Sands series of this period, *Shy the Platypus, Kurrie Kurri the Kookaburra, Silvertail, The Story of a Lyrebird,* and many others! Consequently I was initially amazed by *Wild Life*, a magazine directed primarily at adults with an interest in nature, which devoted so much space to the life of the platypus, koala and wombat — all of which I regarded as well known Australian animals. I was surprised by the implied need for an article to explain that a koala is different from both a monkey and a bear.[2] My first thought was that Australian nature lovers would surely know this already. It was then I realized that the 'crusade for conservation', which was very much a goal of the magazine, required the conversion of the non-enthusiast. Cute, cuddly koala photographs with captions such as "Still Australia's first favorite, the koala or 'teddy bear' sits for his portrait" were a soft sell to the potential convert.[3]

There has been an education of the Australian consciousness of native wildlife. In a short time what was novel to one generation is assumed knowledge to the next. But it is not simply a matter of information about koalas, it is indicative of change in the whole way of thinking about the interrelationships of nature.

The Editor

It was on the first Sunday in November 1938 that Philip Crosbie Morrison, M.Sc., began a series of broadcasts on Melbourne radio. The broadcasts were to publicise the new magazine, *Wild Life*, the first edition of which had appeared in mid-October.[4] *Wild Life* aimed to foster an interest in Australian natural history. It was the brainchild of Sir Russell Grimwade and Sir Keith Murdoch.[5] The radio series was intended to run for only three months, but it quickly became so popular that it continued weekly for twenty years. Within the initial three months, the session commanded 70 per cent of all local listeners at 6 p.m. on a Sunday. Later it went interstate.[6]

No circulation figures are available for the magazine,[7] but although the magazine had a national circulation whilst the radio broadcast was initially only for a Melbourne audience, the radio

Fig 1. *Wild Life* Volume 12, No. 4, April 1950

* Science Faculty Office, University of Melbourne, Parkville, Vic. 3052.

programme outstripped the magazine in popularity. It is significant that while the magazine limped along financially,[8] there were a number of contenders interested in the radio programme when sponsors were called for.[9]

Crosbie Morrison was an interesting choice for the editor of the new magazine. For although it emerged that he had a magnificent media presence on radio, he was orginally chosen for his abilities as an editor. Morrison was a distinguished scientist and also a journalist with the *Argus*. It was important that the new magazine had a sound scientific basis. The 'M.Sc.', which appeared after P. Crosbie Morrison's name in every edition, lent authority to the magazine. But it was important too that the editor could write clearly and simply about scientific matters, and make them appeal to the general public. Most important of all, the editor had to be perceived as a practical person by the well-informed amateur field naturalists who were the principal subscribers.

The conflict between amateur and professional science required some diplomatic talent to overcome. An 'ivory-tower' academic certainly would not have appealed to the popular audience; and worse still, such an editor may have turned away valuable contributors who had no formal qualifications. Many leading authorities in the field sciences did not have university degrees. Where distinguished field workers had been honoured by a scientific society, their contributions to *Wild Life* would be headed with a "by-line" which included the initials of the honour bestowed![10] However, many contributors had neither degrees nor honours listed after their names. Articles were chosen because they were "authoritative, thoroughly informed, but presented in plain language and enjoyable form for (the reader's) edification!" Such articles could only be coaxed from potential contributors by an editor who was respected by both professionals and amateurs, and who had a finger on the popular pulse.

Morrison was obviously aware of the delicacy required in discussing such matters as formal qualifications. His first "Along the Track" column addressed this problem directly. "Along the Track" was not intended to be stuffy or high-brow. It was a "by-the-people-for-the-people" column, "for all those friendly exchanges with which bush strollers are wont to pass the time of day along the track"![12] The opening story in this column was the tale of his scientific expedition to the Great Barrier Reef as a young scientist "with the ink scarcely dry on the parchment which gave (him his) new dignity![13] Charles Hedley was the guide to the two graduates, a geologist, and Morrison, who had completed a Master of Science degree in marine zoology. Hedley was

> "just a dear grey-bearded old man, quiet and gentle of speech, boasting no degrees, and intensely human . . . (A) few days with him sufficed to show us that our equipment was merely the bare bones of knowledge — it was Hedley who clothed the bones with flesh and breathed the breath of life into them!"[14]

However, Morrison was also aware of the limitations of amateur enthusiasts. In his hard fought campaign for the proper management of National Parks, he wrote after the destruction of Wilson's Promontory National Park by fire in February 1951,

> "Not one of the members of the Committee of Management would claim to be an expert in conservation or in management of national parks — they are all public spirited citizens, enthusiastic, but not equipped with special knowledge or experience!"

He did not argue for formal qualifications necessarily, but, in management matters, he recognized the need for training, experience, or better still, both.

Morrison was careful to balance the needs of professionals and well-informed amateurs with the interests of the whole public. The 'crusade for conservation' is dealt with in detail below, but it is interesting to note how the public response to *Wild Life* was constantly and consciously monitored by its editor. His monthly section "Along the Track" was always an open forum for discussion, but right from the first issue he also called for suggestions on the format of the magazine itself. He was obviously inundated with comments when in 1951 the magazine changed its format to "digest" size, and, on the two occasions where it was necessary for there to be a price rise, the following month's editorial was sprinkled with a liberal dose of "worth every penny" comments from readers.[16] The consciousness of a need to keep the readers constantly 'in conversation' with production staff was Crosbie Morrison's special talent. This model also underlay his radio programme, which must have been a model for talkback radio (which still has very high ratings today).

Morrison managed to be both professional and approachable. An article in the magazine *People* featured a photograph of his editorial desk, cluttered with nature specimens including a stuffed platypus.[17] His daily mail arrived not in envelopes but in matchboxes, tobacco tins, jam jars and so forth. His expertise with various cameras (and his willingness to carry heavy equipment to awkward places) complemented both his strengths. Photographs were able to provide detailed scientific information; but they also had a charm and popular appeal which written or spoken words alone could not have.

The photographs used in *Wild Life* were of a consistently high standard, and many showed birds and animals caught in remarkable places by fast thinking photographers. The editorial selection of photographic materials was a reflection of the degree to which Morrison treated the subject as an art and not just a scientific tool.

Visions of Nature

Wild Life appeared at a time when the views of the relationship between man and nature were in transition. The science of ecology was just emerging.

Ecologically based studies of British birds and animals had appeared in Britain at the time of the first world war and soon after,[18] and the British Ecological Society had been set up about 1912.[19] In the first decade of the twentieth century, Americans had been led by a President, Roosevelt, who was conscious of the need for conservation. He was however, guided by Gifford Pinchot, a utilitarian conservationist who argued for the planned development of natural resources to exploit their economic potential.[19] This utilitarian view was in contrast with the earlier Romantic approach to nature, linked in Britain with the name of Gilbert White, and in the United States with Henry Thoreau. Both White and Thoreau knew a small region well. It was their fascination with the interrelationships of nature in their local areas which marked them as forerunners to twentieth century ecology. Both were well informed observers with longitudinal perspective. Thoreau saw within his own lifetime dramatic changes in the New England landscape, and sought to slow the rapid "progress" of his times.[21]

The notion of preserving for the sake of nature herself was not as popular in Thoreau's lifetime (1817-1862) as it was in the 1920s and 30s. The increasing availability of the car led to a rediscovery of the landscape in Britain,[22] and to a new found popularity for the Australian landscape.[23] In the 1930s in Melbourne, numerous walking clubs were established,[24] and walking, camping and other "back to nature" leisure activities were pursued with vigour. Remote areas were explored by many people for whom it would not have been possible before. As Allen expresses it, there was

> "(a) conviction that The Country, that ineffable near-sacred thing, enshrined much that was somehow 'right' and 'good', which was shared by very many at varying levels of profundity and with differing degrees of coherence".[25]

However, the "preservationists" had yet to attain scientific status. Organised science was, in general, in support of the sound management of natural resources as economic commodities. The Rousseau-like view that Nature was her own best manager was held often by non-scientists for aesthetic reasons. The earlier religious views of Nature as God's handiwork (put forward by Paley and others) had been largely displaced by Darwin's evolutionary theory, even among non-scientists, but the aesthetic appeal lingered on: "what was sought after was not scientific understanding but a connoisseurship of the countryside".[26] It was not until the science of ecology came of age that economic grounds could be given for the aesthetic position, and preservation of large areas of land became a scientific goal.

There had of course been awareness of a need for conservation since relatively early times in the Australian scientific community. Ferdinand von Mueller said in 1879:

> "Let us regard the forests as an inheritance given to us by nature, not to be despoiled or devastated, but to be wisely used, reverently honoured and carefully maintained. Let us regard the forests as a gift, entrusted to any of us only for transient care to be surrendered to posterity as an unimpaired property, increased in riches and augmented in blessings, to pass as a sacred patrimony from generation to generation."[27]

The meetings of the Australasian Association for the Advancement of Science (A.A.A.S.) regularly considered the question of the protection of native birds and animals. In 1888 at its first meeting, the A.A.A.S. set up a committee to address this issue chaired by W. Baldwin Spencer, the new professor of Biology at the University of Melbourne.[28] In 1913 there was a call for the protection of forests, particularly in water catchment areas. However, there was still not a unifying scientific discipline to integrate these needs. The drive at the 1913 meeting was for utilitarian conservation like that in America at this time.[29]

By 1932, when A.A.A.S. had become A.N.Z.A.A.S., there was a noticeable difference in the nature of the resolutions of the conference. The conference resolved first that a full biological survey of the fauna of Australia was needed, secondly, that each state should have a small sub-department to co-ordinate and administer laws governing its flora and fauna, and thirdly, that an advisory council should be set up in each state.[30] Each of these resolutions recognized the interrelatedness of living things in the modern ecological sense. The fact that governments failed to act on any of the resolutions was an indication of the popular ignorance of the science of conservation, and the consequent lack of political thrust in these resolutions. No matter how knowledgeable the scientists were, there was no political muscle in their views until the laity, the majority of voters, had appreciated their value.

Wild Life was instrumental in raising the ecological consciousness of non-scientists. As F. G. Elford wrote in November 1945,

> "it is doubtful if one can read any number of *Wild Life* without finding direct or indirect reference to the ecological aspects of living things".[31]

It is, however, a comment on the transitional nature of the times that Elford's column for teachers ('Wild Life in the Schools') should feature an exposition of 'Ecology'. Elford recognized the increasing use of the term in modern

secondary courses in general science and was also aware that there were general science teachers without formal training in biological sciences who did not understand it fully. Elford was a teacher of teachers, so he was in an excellent position to assess teachers' awareness of the issues of ecology. His column gave a very simple and clear explanation of living things, their habitats and the relationships between them.[32] Other general articles, such as 'The Truth about Red Dust' in February of the same year, brought home the practical need for conservation of vegetation in the Mallee district, where soil erosion had led to dark clouds of dust spreading to Melbourne, Canberra and even Sydney.[33]

The visions of nature portrayed by *Wild Life* alter significantly throughout the life of the magazine. *Wild Life* began just before the second World War in an atmosphere of proud nationalism. The new-found pride in things Australian was obviously reflected in the growing interest in unique Australian flora and fauna. The editor chosen for the new magazine was a third generation Australian. It was obviously a time of buying things Australian for Australia's sake. When the new book *Amateur Telescope Making* was reviewed in April 1939, it was described as a "book, written by an Australian for Australians (which) gives more than a conspectus of directions for making a small reflector."[34]

Despite the fact that Australia did not have an industry in optical goods at this time and therefore some of the parts may have been difficult to obtain, a book which tells how to assemble 'inexpensive objectives and eyepieces to make a simple reflector' cannot really be regarded as more useful to one nation than to another. But this was the nationalistic atmosphere in which native wildlife could be regarded as "ambassadors" for Australia.

During the war, nature was portrayed as providing solace from the man-made trials of the time:

> "(T)he contemplation of nature . . . is akin to religion in the calm and contentment it brings to the mind and soul . . . Religion is a matter for individual thought and conscience, but as a secular exercise, *Wild Life* commends to its readers the release from cares which contact with nature can bring. and that is why we feel able, sincerely, to wish our readers a Happy New Year."[35]

This attitude reflected a return to the popular Romantic view of nature, and had very little 'science' about it.

After the war, the vision of nature changed again, and nature was perceived as deserving of protection from the ravages of mankind. Many pages of *Wild Life* were devoted to descriptions of near-extinct species, and to highlighting the problems leading to their plight. Increasingly the solutions to these problems were proposed in political terms. Nature was a source of comfort during the war. After the war it was as if there were a debt to her to repay, and the active repayment of that debt was the 'crusade for conservation.'

In general, throughout the whole period of the magazine nature was seen as something to be visited and preserved, not collected and taken home. For example, the editorial 'Leave them Alone' and accompanying story 'Red Hot Baby', both described the incident where a motorist, on finding a baby platypus on the roadside at Healesville had attempted to sell it to the nearby Sir Colin McKenzie Sanctuary. Morrison described this person as "a vandal of nature" and warned that "there is no money in it — except for the Government by way of a substantial fine."[36] There were also many articles warning against stealing birds eggs. However, remnants of the notion of natural history as 'collection' rather than preservation were present in the feature 'Exquisite Corals of the Barrier Reef' in February 1940. Captions to various photographs described the corals as

"much sought after by tourists and collectors".[37] There was no admonition that collecting corals may have upset the ecology of the area.

The introduction of 'Outdoors' into the title of the magazine in August 1952 spelled a more sporting and less scientific vision of nature. Of course scientists often need to be proficient in various outdoor sports in order to achieve scientific ends. Allen referred to a 'revolution by rucksack' which altered the character of many of the scientific societies in Britain in the 1920's and 1930's [38] This link with scientific ends may have been part of the reason for consciously introducing an outdoor sports section to the magazine. However, there had always been items on hiking, motoring in the country and camping, in addition to the Clubs and Societies diary column in which excursions, camp-outs and hikes were always listed along with meetings. More important was the search for new subscribers. An 'outdoors' cover featuring a skier, an angling scene or horse-riding would be attractive to a new sort of reader. The outdoors enthusiast was yet another reader to whom *Wild Life* would bring "the message of conservation and protection and interest".[39]

The Crusade

The most powerful thrust of the *Wild Life* magazine was its crusade for conservation, and in particular for the establishment of good management for the national parks. In Victoria, Wilson's Promontory National Park had been established in 1909 and by the time *Wild Life* was in circulation, Wyperfeld and many other "sanctuaries" were also established to protect wildlife.

Crosbie Morrison, of course, had other means at his disposal to campaign for educated conservation. Being a well known radio personality he was often called on to speak to all sorts of groups. He was obviously an outstanding speaker. The Bread and Cheese Club in their newsletter *Bohemia* stated that:

Phillip Crosbie Morrison

> "Mr. Morrison has the supreme gift of being able to impart scientific knowledge in an entertaining and understandable manner, and he held his audience from start to finish by the very simplicity of his discourse . . . The afternoon was unanimously voted one of the best ever given at the Club."[40]

He utilised his talents for the crusade in the most unexpected places. In his Pioneers' Memorial Oration delivered at Wangaratta in 1947 under the auspices of a Trust which provided for "the annual delivery of a Public address on matters affecting grazing and agriculture",[41] he addressed a group of farmers, probably one of the groups least sympathetic to the conservation movement. Nonetheless he finished his oration with a plea for the conservation of native plants and animal life:

> "Let no one be able to say in years to come that 'such and such a thing became extinct about the year 1947' or at any other time in our generation".[42]

Wild Life, itself, was a very effective arm of the crusading movement. Right from the start it recognised the need to enthuse the younger generation with natural history. The magazine provided not only material for use in schools, but also a special column "Wild Life in the Schools" which initially simply provided notes for teachers on how the material in each issue could be utilised in classrooms. By the mid-1940s the column formed a separate article itself on a topic or topics useful to teachers. In the 1950s the style changed again, addressing the student rather than the teacher on topics such as 'centipedes', 'crows and ravens' and 'freshwater crayfish'.

What was initially a double page section "For Boys and Girls" grew to sixteen pages in the 1950s entitled "Junior Wild Life and Outdoors". The younger readers were catered for most consciously. Crosbie Morrison's personal contribution to the education of the younger generation was acknowledged in *The Gap* in 1965 when P.W. Draper wrote:

> "A fitting memorial to this great man would be for every person who had heard and admired him to pass on their acquired knowledge to their own children."[44]

The crusade became more political in later years than when the magazine first began. As the prevailing visions of nature became actively political rather than passively aesthetic so did the campaign change in character.

In the 1938 and 1939 issues there was simply a column "Wild Life in the News" which featured items affecting the preservation of wildlife. In October 1939, the editorial called for "the preservation through knowledge and interest rather than through legislation and regulation, of the natural glory of our fair land".[45] This passive educative attitude still prevailed right up to December 1950:

> "Every new subscriber means a widened field of influence for the good."[46]

However, by the middle of 1951 there was a change in the tone (following a devastating fire in Wilson's Promontory National Park):

> "For years we have pleaded with successive Governments for a permanent National Parks Authority for Victoria — an Authority with a staff of experts capable of laying down general policies of efficient management for all national parks. . .".[47]

It was in the 1950s that the national parks of Canada and the United States were regularly featured, including information about the huge sums of money expended on them. Finally there was an overtly political "Call to Victorians" to stand up and be counted at the meeting where the Victorian National Parks Association (V.N.P.A.) was publicly inaugurated in July 1953.[48]

It was soon after the goal of setting up the V.N.P.A. was realised that *Wild Life* was subsumed into the *Sun News Pictorial*. It had always been a predominantly Victorian publication, but in January 1954 it lost its national status altogether. Perhaps Sir Keith Murdoch felt that it had achieved its aims and The Herald and Weekly Times Limited could no longer subsidise a non-profit magazine as "a national service, completely independent of politics and Government bureaucracy".[49]

. . . . .

There is no doubt that the transformation in popular views of native flora and fauna was very dramatic during the period of the magazine. There was probably not, however, a totally ecologically based vision for conservation established until a little later. As late as September 1951 there was an ambivalence even in *Wild Life* to some native animals. An article on crocodile shooting was followed by a carefully worded editorial comment which put forward two views on this matter. The first was that crocodiles should be protected as native animals of

North Queensland and the northern Territory. The other view was that the crocodiles were a danger to man and to other native fauna and that "the shooters are never likely to reduce the numbers significantly, so the argument about natural balance does not apply".[50]

The argument about 'danger to man' closely resembled the campaign used in the United States against "varmints" such as wolves, pumas, bears and coyotes in the earlier decades of this century. Donald Worster, in *Nature's Economy,* put forward the view that until "the reputation of the varmint" improved, America's conservation movement was not really based firmly on an ecological vision.[51] It was not until the 1930s that conservationists in the United States even began to provide sanctuaries for predators, despite the fact that national parks had existed there since 1872.[52] Australia's ecologically based conservation movement has the reputation for being one of the earliest in the world (along with New Zealand, Canada and the United States).[53] It is surprising to find an argument in favour of crocodile shooting in a magazine as conservation conscious as *Wild Life.* It leads one to speculate that if much of our native fauna had inspired more fear (like the crocodile, bear, wolf, etc), the battle for the protection of native species would have been very much more protracted, and the "soft sell" approach of cute photographs would have been totally inappropriate.

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1. Wall, D. *The Complete Adventures of Blinky Bill,* Sydney; Angus and Robertson. 1939.; Gibbs, M. *The Complete Adventures of Snugglepot and Cuddlepie,* Sydney; Angus and Robertson. 1946.; Rees, L. *The Story of Shy the Platypus* and *The Story of Kurri Kurri the Kookaburra,* Sydney; John Sands Pty Ltd (both undated); Watson, I. *Silvertail, the Story of a Lyrebird,* Sydney; John Sands Pty Ltd (undated). Unfortunately all the books in the Sands series are undated: I can only deduce that they came out at that time because my copy of *Silvertail* has a foreword by 'Crosbie Morrison, Editor of *Wild Life*'. (Of course an earlier generation had the benefit of Norman Lindsay's *The Magic Pudding* (1918) but the Sands series has a far more consciously educative style).
2. *Wild Life,* Vol *16,* August 1952, pp 108 ff.
3. See, for example, *ibid,* Vol. *11,* December 1949 p.545.
4. The exact date is not apparent, but the November-December 1938 issue (Vol.*1,* No.2) was a combined one in order that, from the beginning of 1939, the magazine would be available on the first of the month which it was dated. This change was in response to readers' requests.
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6. Willis, J. H. comments on the Author — Dust Jacket: *Along the Track with Crosbie Morrison.* Melbourne, Whitcombe and Tombs, 1961.
7. "The Herald and Weekly Times Ltd" did not audit circulation figures until the 1960s. (Telephone conversation with Mr. Jim Lawrence, May, 1985).

8. Several editorials and pleas for subscriptions and the article by J. R. Garnet 'A Tribute to Crosbie Morrison' in *The Victorian Naturalist,* Vol. *75,* June 1958 pp 21-24, all confirm this point.
9. *ibid,* p. 21.
10. For example, Charles Barrett, F.R.Z.S; Alex H. Chisholm, F.R.Z.S., C.F.A.O.U.; Roy P. Cooper, R.A.O.U.
11. Editorial, *Wild Life,* Vol. *13,* January 1951 p. 5.
12. These words appeared in every edition of *Wild Life,* except the last (January 1954).
13. 'Along the Track', *Wild Life,* Vol *1,* October 1938, p. 29.
14. *ibid..*
15. 'Regret but no Surprise', *Wild Life* Vol *13,* March 1951, p. 307.
16. The price rises occurred in 1940 (6d to 1/-) and 1951 (1/- to 2/-).
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29. Bardwell, *op. cit.* pp. 177-178.
30. *Proceedings of the 21st Meeting of A.N.Z.A.A.S.,* (Sydney) 1932.
31. Elford, F. G. writing as "Ped", 'Ecology in General Science', *Wild Life,* Vol *7,* November 1945, p. 351.
32. *ibid.*
33. 'The Truth About Red Dust' *Wild Life,* Vol. *7,* February 1945, pp. 39-42 (No author is listed, so it was probably Morrison himself).
34. Review by "Bookworm", *Wild Life,* Vol. *1,* April 1939, p. 31.
35. Editorial, *Wild Life,* Vol. *3,* January 1941, p. 4.
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37. 'Exquisite Corals of the Barrier Reef', *Wild Life,* Vol. *2,* February 1940, pp. 20, 21.
38. Allen, *op. cit,* p. 227.
39. Editorial, *Wild Life,* Vol. *13,* February 1951.
40. *Bohemia* (Report on The July Meeting), Melbourne; 1 August 1945, p. 6.
41. (Introduction to) P. Crosbie Morrison, 'Before the Pioneers — Wild Life of the North East', *Pioneers' Memorial Oration,* Wangaratta, 11 November 1947, p. 1.
42. *ibid* p. 9.
43. This is just a sample — from *Wild Life,* Vol. *15,* p. 571, Vol. *16,* p. 273 and the last issue (No Volume no., January 1954) p. 74, respectively.
44. Draper, *op. cit,* p. 56.
45. Editorial, *Wild Life,* Vol. *1,* October 1939, p. 4.
46. Editorial, *Wild Life,* Vol. *12,* December 1950, p. 535.
47. 'Regret but no Surprise' *op cit,* p. 307.
48. 'Call to Victorians', *Wild Life,* Vol. *18,* July 1953, p. 9.
49. 'Looking Back', *Wild Life,* Vol. *14,* December 1951, p. 509.
50. 'Crocodile Shooting', *Wild Life,* Vol. *14,* September 1951, pp. 222-231; Editorial Comment p. 231.; The 'danger to native fauna' (and flora) argument has been used in justifying the culling of kangaroos in 1984 at Hattah-Kulkyne National Park in a 1980's ecological management strategy. I would certainly not regard kangaroos as 'fear inducing' in the popular mind, so the arguments below would not apply. Nor should the situation in a National park, which is a sanctuary for *all* animals be compared with a more general situation.
51. Worster, *op. cit,* pp. 258-290.
52. *ibid,* p. 277.
53. Bardwell, *op. cit,* p. 1.

NEW BIRD REFERENCE

This is to announce a new bird reference "Species Index of Australian Native and Introduced Birds — Victorian Naturalist Vols. 1-100" compiled by Jack Hyatt — 95 pages. This can be ordered from The Secretary, F.N.C.V. C/- National Herbarium, Birdwood Ave., South Yarra, Victoria, 3141, price $12 plus $2 postage.

Notes on Some Beetles (Coleoptera) Associated with *Xanthorrhoea johnsonii* (Xanthorrhoeaceae) in the Brisbane Area, South-East Queensland

BY T. J. HAWKESWOOD*

Abstract

A list and notes are provided on the abundance, occurrence and ecology of 21 species (10 families) of Coleoptera associated with the leaves of the grass-tree *Xanthorrhoea johnsonii* Lee in the Brisbane area during Sept. 1982-Jan. 1983. Some species utilize the leaves for protection and food while others use them for resting and mating purposes.

Introduction

(a) Insect/plant relationships

Froggatt (1896) appears to have been one of the first naturalists interested in the relationships between insects and the indigenous grass-trees, *Xanthorrhoea* spp. He recorded the following ten beetle species as host specific on four (unnamed) *Xanthorrhoea* species in the Sydney area near the turn of the century and provided notes on their biology wherever known — *Trigonotarsus rugosus* (Boisduval), *Acantholophus marshami* (Kirby) and *Notiosomus (Tranes)* sp. (Curculionidae), *Micropoecila breweri* Janson (Scarabaeidae) (also recorded on the flowers of "dwarf Angophora" *(Angophora costa*ta)), *Cisseis duodecimmaculata* (Fabricius) (Buprestidae), *Depsages (Symphyletes) solandri* (Fabricius) (Cerambycidae), *Xantholinus erythropterus* (Erichson) (as *Xanthochilus*) (Staphylinidae), *Hybraenia subsulcata* (Macleay) (?) (as *Allecula*) (Alleculidae) and *Hololepta sidnensis* Marseul and *Platysoma* sp. (Histeridae).

Nothing appears to have been written on the biology of grass-tree beetles for at least another 60 years, until Mulder (1964) provided some notes on *Depsages solandri* (Fabricius) (Cerambycidae), *Tranes xanthorrhoeae* Lea, *Trigonotarsus rugosus* (Boisduval) (both Curculionidae) and *Aphileus lucanoides* Candeze (Elateridae), presumably from the Sydney district as well. This author's notes on the former three species are basically similar to those of Froggatt to which reference is not given in this paper.

During his monumental work on Australian Coleoptera, A.M. Lea described two new distinctive species from *Xanthorrhoea*, i.e., *Notiosomus (Tranes) xanthorrhoeae* (Curculionidae) (Lea, 1899) and *Diplocoelus xanthorrhoeae* (Biphyllidae) (Lea, 1921), with *Diplocoelus* being erroneously placed in the Erotylidae or Mycetophagidae by early workers, including Lea.

(b) Description of *Xanthorrhoea johnsonii* Lee

This species is an arborescent grass tree ("black-boy"), usually growing on hill slopes in dry sclerophyll forests in coastal localities. Plants usually have an unbranched caudex (trunk) measuring to two metres in height and 20-40 cm in width. The crown of leaves is usually divided into an almost erect portion of young dark green or pale leaves and a narrow covering of old, dead leaves, reflexed over the trunk (Lee, 1965). The mature leaves are narrow-linear, quadrangular in cross-section, 80-120 cm long and 2-3 mm wide, with sharp margins. Each plant has the potential of producing a scape (stalk) possessing a large spike containing hundreds of nectar-bearing cream flowers during the summer flowering season following fire and/or rain. (All *X. johnsonii* examined in this study were non-flowering plants). The species has a somewhat disjunct distribution from north Queensland (Mareeba-Petford area) to Mt. Spec and Townsville, to Springsure in central-

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eastern Queensland (Lee, 1965). The species also occurs commonly around Brisbane and north-eastern New South Wales on the highlands.

(c) Field observations and collections

Examinations were undertaken on approximately 50-60 *X. johnsonii* plants at two sites (i.e. Burbank area, c. 10 km E of Brisbane and Griffith University campus, Brisbane), on at least five days in every month between September 1982 to January 1983. Plants were carefully approached in the field, cursorily examined for beetles resting on the leaves and then closely examined in the centre amongst the densely crowded bases of mature leaves and non-chlorophyllous young leaves. Voucher specimens of all species encountered are deposited in the Australian National Insect Collection (ANIC) and in the author's private collection.

List and notes on individual species

In the list below, species abundance is given on a monthly basis, i.e. "rare" indicates less than three specimens seen per month per site, "few" three to 10 specimens, and "common" more than 10 specimens. The sites are listed as G = Griffith University campus and B = Burbank.

(a) Biphyllidae. *Diplocoelus xanthorrhoeae* Lea (Oct.-Nov. G, B. Common). Adults were usually found in groups of 4-8 beetles in about 25% of all plants examined. They scurry away to hide amongst leaves when disturbed. Nothing has been recorded on the biology of this taxon since Lea (1921, pp. 364-365) described it from *Xanthorrhoea* species at Sydney (New South Wales), Huon River (Tasmania) and Swan River (Western Australia), indicating a wide distribution for the species. It may breed in rotting vegetation found in moisture reservoirs amongst the leaves near the top of the caudex.

(b) Buprestidae. *Melobasis cuprifera* (Kirby) (Oct. G. Rare). Two single specimens were found resting on outer leaves of small grass-trees. There is no evidence that this beetle feeds on leaves or breeds in the trunks.

(c) Cerambycidae. *Depsages (Symphyletes) solandri* (Fabricius) (Sept.-Nov. G, B. Few). Adults were usually found as single specimens feeding on the non-chlorophyllous bases of young leaves. Upon disturbance, most beetles clung tightly to the leaves in order to resist capture. Froggatt (1894, p. 115) briefly described the biology and larva of the species. The larvae attack the flower stalks, feeding upon the dry woody pith and form straight, irregular tunnels down the centre. Pupation takes place at the base of the flower stalk. Froggatt (1896, p. 78) noted that the beetle was usually uncommon in the Sydney area except for the "exceptional season". Mulder (1964) noted that adults were usually found hiding amongst leaves in pairs or as single specimens and become active after sunset. In the Brisbane area the adults were active during the day often feeding on young leaves.

(d) Chrysomelidae. *Crioceris fuscomaculata* Clark (Sept.-early Nov., G, B. Common). Up to seven beetles were found per plant, usually in groups amongst the young leaves. Adults of this species are distinctive in being deep red in colour with a large black blotch on the elytra. They usually drop further into the plant upon disturbance. About 30-35% of all grass trees examined contained this species. Feeding and flight were not observed. Adults emit a soft squeaking noise if handled. Nothing is known of their life-cycle.

Brachycaulus klugi (Saunders) (Sept.-Oct. G. Rare). A poorly collected species about which nothing is known. Single specimens were resting on lamina of outer mature leaves.

Cleptor inermis Suffr. (Sept.-early Nov. G, B. Common). Adults commonly feed on the flowers of *Pultenaea villosa* Willd. (Fabaceae) in the Brisbane area and often rest on saplings of *Eucalyptus* species (Myrtaceae) and on the leaves of *Leptospermum* sp. (Myrtaceae), *P. villosa* and

X. johnsonii. Populations are dispersed over large areas. Resting on leaves of *Xanthorrhoea* and other plants may be associated with mating behaviour and escape mechanisms. Most Australian chrysomelids as far as known are leaf-feeders, but *C. inermis* appears to be an exception, feeding on the petals of *P. villosa* as a primary food source.

Cryptocephalus argentatus Chapuis (Oct. G. Rare). One pair collected on leaf tip in copula.

Cryptocephalus dichrous Chapuis (Oct. G. Rare). One specimen collected on an outer leaf.

**Octatoma scabripennis* (Guerin-Meneville) (Sept.-Oct. G. Few). This is one of several species introduced from South America as biological control agents of *Lantana camara* L. (Verbenaceae) and is well established in the Brisbane area. At the Griffith site, adults were found deep within the young leaves and feigned death (thanatosis) upon disturbance, often falling further into the plant to escape capture. The beetles may have been overwintering.

Paropsis ornata Marsham (Sept.-Nov. G., B. Rare). Single specimens have been found resting on outer mature leaves. Feeding has not been observed.

Paropsis trifasciata (Boisduval) (Sept. G., B. Rare). One specimen collected on an outer leaf.

Paropsis sp. near *P. inconstans* Blackburn (Sept. G. Rare). One specimen collected on an outer leaf.

(e) Alleculidae. *Aethyssius viridis* (Boisduval) (Sept.-Nov. G., B. Few). Adults often rest on the outer leaf laminae but occasionally hide amongst the young leaves. I have recorded them (in low numbers) feeding on nectar and pollen of *Leptospermum* flowers in the Brisbane area. Froggatt (1896, pp. 80-81) briefly described the larva and pupa of *Hybraenia subsulcata* (Macleay) (?) and noted that the larvae were active little grubs living in rich black mould produced by the decaying caudex and were usually common during July and August in the Sydney area. Froggatt also noted that adults emerged from pupae during November and commonly hid amongst the leaves of the grass-trees. *Aethyssius viridis* may have a similar life-history.

(f) Coccinellidae. *Harmonia (Leis) conformis* (Boisduval) (Nov.-Jan. G. Few). Adults sometimes occur in small groups of 2-5 amongst young leaves; single specimens may also nest on outer mature leaves. No large-scale overwintering aggregations, like those reported by Smithers (1970), Anderson and Richards (1977) and Smithers and Holloway (1982) were observed. Observations by these authors indicate that *H. conformis* aggregates in both summer and winter and that these aggregations may last for several months and may occur during a series of exceptionally dry years. Adults are dispersed by the appearance of heavy summer rains.

(g)Cuculionidae. *Notiosomus (Tranes) xanthorrhoeae* (Lea) (Jan. G. Rare). One specimen was collected from amongst young leaves and feigned death upon capture. Froggatt (1896, p. 77) noted that the unidentified species of *Tranes* he collected last century from the Hawkesbury River was uncommon and occurred at the base of the flower stalk and amongst young leaves. He was unable to find the larva. Mulder (1964) noted that the species attacked the base of the leaves and that they produced a light brown, "mucous secretion" on the leaf bases. Mulder also noted the rarity of this beetle in Sydney.

Trigonotarsus rugosus (Boisduval) (Sept.-early Dec. G., B. Few). Adults occur as single specimens facing head downwards, usually clinging to a group of young leaves. Froggatt (1896, pp. 76-77) briefly described the larva, pupa and adult and noted that the larvae bore holes into the fibrous cortex near the bottom of the trunks where they feed for a long time, then pupate before the adults emerge. Froggatt also noticed that the beetles clung tightly to the foliage by use of a

spine on the tibiae. They also dig these into the flesh if handled, causing a painful sensation! Mulder (1964) noted that adult beetles often died before reaching the cortex where the eggs are deposited. The larvae have the ability of killing the host blackboy while the adults may remain for a considerable time in the dead or dying trunks before gnawing their way out. Adults have well developed wings and are nocturnal in habit (Mulder, 1964).

(h) Elateridae. *Ascesis australis* Candeze (Oct. G., B. Rare). Usually found as single specimens on outer leaves.

Conoderus sp. 1. (Sept. G. Common). Up to 20 beetles were encountered on several blackboy plants, actively mating or flicking and flying from resting posts and returning. The species appeared only locally common and adults were present for about a week.

Conoderus sp. 2. (Sept. G., B. Common). This species displayed similar behavioural traits to *Conoderus* sp. 1.

(i) Histeridae. *Hololepta sidnensis* Marseul (Sept.-Oct. G., B. Rare). Adults occur as single specimens amongst young leaves. Froggatt (1896, p. 79) recorded that this was one of the most common beetles associated with the blackboys in the Sydney area and occurred at the top of the decaying caudex or between the caudex and outer sheath of leaves. Despite the abundance of the species, Froggatt was unable to find the larva or pupa. Being members of a carnivorous family, adults may feed on Lepidopteran larvae which are common amongst the grass-trees in the Brisbane area.

(j) Scaphidiidae. *Scaphidium punctipenne* Macleay (Sept.-Oct. G., B. Rare). Single specimens were found resting on outer leaf laminae on two occasions, one of which eluded capture by darting from the leaf at the slightest disturbance.

Discussion

The beetles collected from *Xanthorrhoea johnsonii* in the Brisbane area may be divided into two groups on the basis of their association with this plant. One group, comprised of 7 species, viz. *Diplocoelus xanthorrhoeae, Depsages solandri, Crioceris fuscomaculata, Aethyssius viridis, Notiosomus xanthorrhoeae, Trigonotarsus rugosus* and *Hololepta sidnensis,* are "strongly associated" with *Xanthorrhoea,* with at least two, i.e. *D. solandri* and *T. rugosus,* definitely known to breed exclusively in the trunks or inflorescences and to feed on leaves in the adult stage. In the case of the carnivorous *Hololepta sidnensis,* the adults are probably predaceous on other larvae living amongst the grass-trees and the *Hololepta* larvae may develop in the rotting caudex, although the early life-stages of this histerid beetle remain undiscovered. The eggs, larvae and pupae of *Diplocoelus xanthorrhoeae, Crioceris fuscomaculata* and *Aethysssius viridis* are also unknown but the adults (with the exception of *A. viridis*) have not been collected on any plants other than *Xanthorrhoea* (Hawkeswood, pers. obs. 1982, and from museum specimens of these species). This fact suggests a dependance on the grass-trees for completion of all, or most of their life-cycles.

The remaining 14 species which comprise the second group are not "strongly associated" with *Xanthorrhoea,* since some use the leaves for mating purposes, others for sites to undergo procrypsis in order to be concealed from potential predators and a few species appear to use the base of the leaves as overwintering sites. Most Chrysomelidae appear to be incidental visitors, but some, such as *Octatoma scabripennis* which normally feed on *Lantana camara* (Verbenaceae), appear to use the base of the leaves as overwintering sites.

The largest number of beetle species associated with *Xanthorrhoea* at Griffith University campus, occurred during September and October with a rapid decline in November, resulting in only two species being collected during December and January (Fig. 1). When the number of "strongly associated" beetle species is

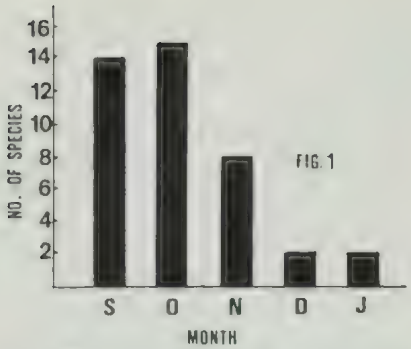

Fig. 1. Histogram showing the number of beetle species collected from *Xanthorrhoea johnsonii* plants each month during Sept. 1982–Jan. 1983, at Griffith University, Brisbane, south-east Queensland.

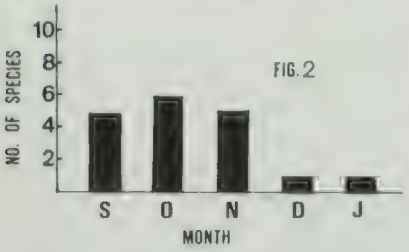

Fig. 2. Histogram showing the number of beetle species regarded as "strongly associated" with *Xanthorrhoea johnsonii* plants each month during Sept. 1982–Jan. 1983, at Griffith University, Brisbane, south-east Queensland. (These species are *Diplocoelus xanthorrhoeae, Depsages solandri, Crioceris fuscomalculata, Aethyssius viridis, Notiosomus xanthorrhoeae, Trigonotarsus rugosus* and *Hololepta sidnensis).*

plotted (Fig. 2), a similar trend occurs, although the decline in November is not as marked. Each month, the number of "strongly associated" species comprises a large proportion (i.e. 32.5-62.5%) of the total number of beetle specis (Fig. 3). The decline in beetle species during November may be explained by the natural death of adults and not to high levels of predation. Their life-cycles are probably correlated with certain climatic conditions, such that, as temperatures increase, and moisture levels decrease, during spring to summer, the adults have mated during this time, eggs have been laid by the females for the next generation and adults finally die.

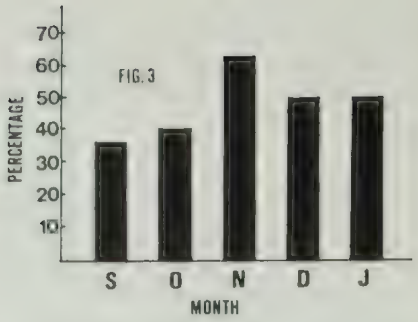

Fig. 3. Percentage of "strongly associated" beetle species to total number of species collected from *Xanthorrhoea johnsonii* plants each month during Sept. 1982–Jan. 1983, at Griffith University, Brisbane, south-east Queensland.

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Five Good Camp-outs (Cathedral Range, Snowy Plains, Mt. Kooyoora, Howqua River and Creswick)

By J. H. Willis*

An essential activity of the F.N.C.V.'s Mammal Survey Group, since its inception in April 1960 (as a "Fauna Survey" Group), has been that of camping out in various parts of Victoria. Over recent years a few members with more general interests, including botany, have felt that a couple of week-end camps a year would be worth trying, especially for the younger and more active who had found that the Club's usual day trips by coach gave too little opportunity for walking, exploring or really getting to grips with the natural history of an area. So John Milligan volunteered to organise a series of camps and longer bush walks, beginning in early spring with Cathedral Range State Park which he and his wife Val know particularly well. The following is a chronological report of some impressions (chiefly botanical) gained from these first five ventures.

1. Cathedral Range (2-4 September, 1983).

It was decided to travel straight to a camping ground at Little River (eastern foot of the range) after work on the Friday evening. Rain had fallen in the mountains for several days past, and we arrived about 10 p.m. to find our prospective camp-flat flooded by the swollen river — an old wombat wandered forlornly, doubtless forced from his inundated burrow; nevertheless, tents were erected by torchlight and in a slight drizzle — among blackwoods and silver wattles around the drier periphery.

Next morning the eight participating stalwarts drove southward (upstream) to Cooks Mill site, parked the vehicles and then continued westerly on foot, along the edge of a pine plantation into Mac Lennans Gully — a beautiful spot, with ferngully vegetation under tall riparian Manna Gums (*Eucalyptus viminalis*). It was sad to observe several groves of dead treeferns (*Cyathea australis*), apparently recent victims of exceptionally severe drought over the past two summers. Across MacLennans Gully it was only a short walk northerly to the mouth of an impressive gorge, cut by a tributary stream. Here among the sandstone boulders and mossy ledges was a delightful display of early wildflowers, notably sticky Boronia (*B. anemonifolia*), Rosy Baeckea, (*B. ramosissima*) and Common Heath (*Epacris impressa*); another shrub, but not in bloom, was Lemon Bottlebush (*Callistemon pallidus*). The Musky Caladenia orchid (*C. gracilis*) added interest to the walk back through open perppermint forest.

After lunch, at camp, the afternoon was devoted to a relatively short excursion along Knobby Spur, above the steep easterly slopes into Little River. This narrow curving ridge, often of knife-edge proportions, afforded superb panoramic views of pastoral country to the north, the beetling bulk of the main Cathedral Range to the west and south. It was an excellent vantage place for our geological friend, Tom Sault, to explain the physiography in terms of remote land-history — through Devonian sand depositions and rhyolitic lava flows of some 300 million years ago to more recent uplifts and cycles of erosion, leading to the present dramatic land forms.

Knobby Spur carries a more stunted forest (*Eucalyptus goniocalyx, E. dives, E. radiata and E. macrorhyncha,* with some *E. sieberi* in higher parts towards Chapel Hill). Lightwood (*Acacia implexa*) was

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noted here, but nowhere else in the Cathedral State Park. The ground flora was rather sparse, including two bitter peas (*Daviesia ulicifolia, D. virgata*), pink bells (*Tetratheca bauerifolia*) and three beard-heaths (*Leucopogon virgatus, L. biflorus* and uncommon *L. stuartii*). Among seasonal herbs the five orchid species *Chiloglottis gunnii, Corybas diemenicus, Pterostylis longifolia, P. nutans* and *P. pedunculata* were in bloom, not so the bulbine lilies (*B. bulbosa*), occasional perching plants of rock ledges unobserved elsewhere in this park. Blanket Fern (*Pleurosorus rutifolius*) occurred in some shady rock crevices, in addition to the ubiquitous Rock Fern (*Cheilanthes austrotenuifolia*) and Necklace Fern (*Asplenium flabellifolium*).

We were joined on our big Sunday walk, to the serrated crest of the main Cathedral Range, by Mrs. Peg Lade and another member of the Yea F.N.C. A steady climb of about 370 m (1200 ft.) brought us to the lunch stop at Ned's Peak — only 2 km directly south-west from camp. Pink-flowered masses of Sticky Boronia, to 1 m tall, were abundant around this isolated knob whence we scrabbled down a precipitous southern spur for a good view into the narrow gorge visited yesterday. Farther south, the spectacular Sugarloaf peak (910 m) dominated the skyline.

A deep saddle leads westward from Ned's Peak up onto Cathedral Mountain at 870 m — an exciting experience to burst suddenly out of the forest upon an abrupt edge dropping almost sheer for about 340 m. Besides boronia and bottlebrush again, the ridge top presented us with several other shrubs for the first time, viz. *Grevillea alpina* (rare), *Pultenaea mollis, Platylobium formosum, Spyridium parvifolium, Prostanthera rotundifolia, Olearia phlogopappa* and *Helichrysum semipapposum*; the two flax-lilies *Dianella revulata* and *D. tasmanica*, and Waxlip Orchid (*Glossodia major*), were noted in this summit area. The descent northward to Little Cathedral resembles a staircase on the knife-edge, giving magnificent prospects of the Acheron Valley at one's feet and of ranges away beyond to the Strathbogies. Little Cathedral summit to Little River camp is down a very steep track where it is only too easy to slither uncontrollably into disaster — a decided strain on ageing knee-caps! So ended a most enjoyable excursion. Of 164 species of higher plants currently recorded for Cathedral State Park, we had noted 152 including 12 kinds of ferns and 11 orchids. Numerous mosses and a few interesting fungi were also seen.

2. Snowy Plains (27-30 January, 1984).

When the leader's party arrived about midnight on Friday of the Australia Day week-end, a camp site had already been established by early comers (including Tom Sault) — on a small grassy clearing among snow gums about 5 km north from the Snowy Plains airstrip. It was an idyllic spot, affording easy access to the open Plains proper, to rocky gully-heads carrying Mountain Gum (*Eucalyptus dalrympleana*) and Alpine Ash (*E. delegatensis*) and to the awsome depths of Bryce's Gorge slightly northward. Next morning our numbers swelled to over thirty as members of the F.N.C.V.'s Mammal Survey Group participated, including Club President, Wendy Clark. Melbourne Herbarium was represented by Stephen Forbes and professional pathology by Dr. Gretna Weste; Peg and Doug Lade came along from Glenburn. Some enthusiasts who wanted to view and photograph Bryce's Gorge in good morning light left soon after breakfast, appreciated the pink waxy flowers of *Crowea exalata* along the scarp, and were back in time to join their companions for the main walk of the day out to Mt. Reynard.

Vehicles shuttled us to a convenient parking flat south of the airstrip (at the foot of diminutive Mt. Lookout), whence it was an easy stroll generally southward along cattle pads to the broad, rather undistinguished summit area of Reynard

(about 1700 m). The track led through beautiful unburnt groves of Snow Gum (*Eucalyptus pauciflora*) where shade-loving clubmoss (*Lycopodium fastigiatum*), Lilac-berry (*Trochocarpa clarkei*), so-called carraway (*Oreomyrrhis eriopoda*) and Mountain Cotula (*C. filicula*) flourished, through leguminous shrubberies of Mountain Shaggy-pea (*Oxylobium alpestre*), *Bossiaea foliosa* and shorter *Hovea longifolia* var. *montana*, delightful herbfields dominated by members of the daisy family (*Brachycome, Craspedia, Podolepis, Leptorhynchos, Helichrysum* and *Senecio* species), grasslands and occassional moss-beds along boggy water courses. Interesting little rosette plants and mat-formers of damper spots included *Caltha introloba, Ranunculus millanii, R. pimpinellifolius, Geranium antrorsum, Mitrasacme serpyllifolia, Plantago antarctica, Pratia surrepens, Velleia montana, Scaevola hookeri, Brachycome decipiens* and the turf-forming lily *Herpolirion novae-zelandiae* — all except the *Caltha* (Alpine Marsh-marigold) still in bloom.

Communites of almost pure hovea must have been a dazzling sight two months previously, when smothered with rich purple pea-flowers; we found them a preferred habitat for the Alpine Spear-grass (*Stipa nivicola*) — only member of its widely distributed genus to enter subalpine terrain. This cold-tolerant grass is remarkable for the relatively few large spikelets (often less than 6) and their exceptionally long awns (to 10 cm). The summit rocks of Mt. Reynard, just above tree-line, supported low and typically espaliered shrubberies of Yellow Kunzea (*K. ericifolia*, syn. *K. muelleri*), in heavy honey-scented blossom, while down hill to the east were tall thickets of palest mauve-flowered Alpine Mint-bush (*Prostanthera cuneata*). Hereabouts were many holes of a large ferocious-looking wolf spider (*Lycosa* sp.); on such a warm day its was easy to coax out an occupant by tickling its silk-lined lair at the entrance, with a twig or stalk of grass. Bulky mountain grasshoppers (*Acripeza reticulata*), with brilliantly blue and red abdomens and raised black wings, occasionally bumbled over the grass. We drank in the wonderful mountain-scape, from far away Mt. Buller and nearer Mt. Howitt in the west to Cobbler in a more northerly direction and the spectacular Barry Mountain chain to the north-east.

Overnight our mammal survey team had been busy while others slumbered, and the trophies of trapping were proudly displayed (before release of these captives) early next morning. The ingenious bat trap, consisting of a slanting wired frame, with deep hessian pouch, erected above the end of a small narrow pool, netted three different species (two kinds of forest bat, and six specimens of the white-striped bat which is not often caught). A bush rat was also trapped, but the area seems poor for smaller mammals.

Sunday's jaunt was to Mt. Howitt (1750 m), but again we had motorized transport for several kilometres to the point where Macalister Springs walking track leaves the main Howitt forest road. A gentle climb to the Springs was chiefly through rather open snow gum woodland, heading several moss-beds where yellow spikes of Alpine Bottlebrush (*Callistemon sieberi*) evoked admiration. At the edge of one small plain, snow gums had been invaded by an isolated but very vigorous patch of the introduced brier rose (*Rosa rubiginosa*) in attractive bloom — probably carried there as seed by birds or cattle from lower country. The uncommon native geum (*G. urbanum*) also surprised us in a nearby shaded gully head; although in the rose family, it outwardly resembles a tall branching buttercup, though with longer hooks to the fruiting achenes.

Macalister Springs, with its striking A-frame Velleio Gantner Memorial Hut, was a good excuse to spell for ten minutes or so and take a closer look at the flora. The unlittered surroundings are clean, and it's refreshing to drink from the actual spring

which splashes down among mosses and ferns (principally *Polystichum proliferum* and *Blechnum penna-marina*). Slopes around here are covered with Tasman Flax-lily (*Dianella tasmanica*) and, among shrubby components of the snow gum community, we had not previously encountered the two proteads, *Orites lancifolia* and *Grevillea victoriae*, spindly *Leucopogon gelidus*, mat-forming *Coprosma nivalis* nor Large-leaf Daisy-bush (*Olearia megalophylla*). The steep track above Macalister Springs soon follows an exposed edge, presenting awesome views down into Terrible Hollow, as across to the startling outline of Razor and Viking in the nearby Barry Mountains. A natural rock garden of prostrate pink-flowered *Baeckea ramosissima* and blue *Brachycome rigidula* clings to ledges along this escarpment.

Ahead, to the right, are the buttresses and serrated peaks of the Crosscut Saw, connecting Mt. Howitt with Mt. Speculation to the north. Near the junction of tracks to the Saw and Howitt are several interesting alpines, e.g., umbelliferous *Aciphylla glacialis* (Fig. 1), the male plants of which produce lacy trusses (to 60 cm) of small cream honey-scented flowers, but the females consist of greenish ovaries in sparse umbels and are rather nondescript. On the west-facing slopes, among stunted snow gum thickets, occur two distinct forms of the Silver Daisy (*Celmisia asteliifolia*) — one with narrow grass-like foliage, the other broad-leaved (to 4 cm wide), growing side by side though not interbreeding. The latter has been called variety *latifolia* but it may warrant recognition as a distinct species.

The gentle rise towards Mt. Howitt summit area, above tree-line, is through grassland (*Poa, Deyeuxia, Agrostis* and *Danthonia* species) and extensive alpine herbfields — a kaleidoscope of colour at the time of our January visit. Here vivid magenta spikes of Grass Trigger-plant (*Stylidium graminifolium*) vied with white, blues or yellows of the prevailing daisy family; conspicious genera are those already mentioned for Mt. Reynard, but the diversity seems greater on Howitt. Another lovely flower, mauve or white, was the trim herbaceous (and parasitic) eyebright, *Euphrasia lasianthera*, in the foxglove family. The return trek proved uneventful, but spirits were buoyant after such a bright, balmy, wonderful day. By dusk heavy clouds heralded a cool change and it rained intermittently all night.

The plan had been to spend Monday morning in a rough scramble down Conglomerate Creek Falls in Bryce's Gorge where grow such exciting rarities as *Epilobium brunnescens* and the ferns *Cystopteris filix-fragilis, Asplenium hookerianum, Blechnum vulcanicum* and *Grammitis armstrongii*. But it would have been disappointing, if not dangerous, to attempt such a descent under wet misty conditions; that venture was wisely deferred until some possible future camp-out. Before packing up for an earlier return to Melbourne, some of us found an inspection of the nearer environs quite rewarding. For instance, seven kinds of orchids were observed quite close to the tents (*Gastrodia sesamoides, Caladenia lyallii, Pterostylis cycnocephala* and *P. decurva* amongst grass under snow gums, *Diuris pedunculata, Prasophyllum alpinum* and more showy *P. suttonii* on open marshy ground). Despite much searching, no specimen could be found of the purplish-black midge-orchid, *Prasophyllum densum*, which in Victoria is apparently restricted to the Snowy and Bennison Plains area. Two hakeas (*H. lissosperma* and *H. microcarpa*) occur here, the latter accompanying spindly *Leptospermum myrtifolium* in rather boggy places where delicate little *Pultenaea tenella* was also noted.

Our final tally of plant species for the Snowy Plains (above an altitude of 1400 m) was 132, of which 90 had been seen in flower. This compared more than favourably with the 129 species listed by T. P. Farrell and D. H. Ashton in their

Fig. 1 *Aciphylla glacialis*, Mt. Howitt.

"Ecological studies on the Bennison High Plains" published in *Victorian Nat. 90:* 286-298 (Oct. 1973) — and that was the consummation of a much longer survey in March 1969. A brief account of another excursion into this country, during January 1972, will be found in V. Barton's "Mt. Howitt", printed in the Bairnsdale Field Naturalists' journal *The Clematis 13:* 12-13 (Nov. 1974). So ended a successful and very pleasurable summer foray to the higher country.

3. Mt. Kooyoora (30 June-1st July, 1984)

It was thought prudent to hold a mid-winter camp in drier box country north of the Divide, rather than a coastal or tall forest venue where seasonal weather could be less favourable. Mt. Kooyoora-Melville Caves reserve (between Wedderburn and Kingower) was chosen because of its general interest and accessibility, within three hours driving along good roads from Melbourne. We set out after work on Friday and were erecting our tents, on a grassy wooded spur just south of Mt. Kooyoora tops, by 9.30 p.m. — again by means of torches. Morning light revealed only eight "takers", but what the party lacked in numbers was amply compensated by enthusiasm.

This is all granite country, replete with massive slabs, gigantic tors, cave-like recesses and, of course, splendid viewpoints; aboriginal camp-sites and wells dot the sandy verges. Five species each of *Eucalyptus* and *Acacia* contribute to the forestal cover which, in places, is quite open and park-like. The ground flora consists chiefly of grasses — a dozen indigenous species and as many aliens. Ten members of the lily family are on record and 16 different orchids, but none of these were in flower during our winter visit. There are six ferns, chiefly small kinds of rock crevices. One surprise was a sprinkling, right near camp, of shapely Black Cypress-pine (*Callitris endlicheri*) which is a very isolated occurrence and the most westerly in this state, as are

the more frequent communities of *Eucalyptus blakelyi* (a red gum) and *Acacia paucijuga* (a tall bipinnate wattle) — the latter also at nearby Mt. Korong.

Saturday, June 30th, was a bright warmish day, ideal for walking, and it happened to be the anniversary of Baron von Mueller's birthday 159 years before. One reflected that, although the great botanist never explored this particular granite massif, he *had* seen it as he tramped along the Avoca River, only about 20 km to westward, in early Dec. 1853. First, we looked at old White Swan mica mine where clear quartz crystal was also obtained, for use in crystal wireless sets that were in vogue during the early 1920's. Then began a short but bouldery climb onto the narrow summit of Kooyoora where we lunched against a windbreak of convenient rocks, enjoying an expansive panorama northwards. Not far across lay the isolated, sugarloaf-like Mt. Korong (also granitic) where Hermann Beckler had made the first collection of plants on 14 Oct. 1861, while accompanying G. B. Neumayer's magnetic survey party — those specimens are still in the Melbourne Herbarium.

For the afternoon walk, a long boulder-strewn spur trending N.N.W. seemed to invite exploration. So we dropped suddenly onto it from Kooyoora's north-western bluff and, in doing so, were rewarded by a fine waist-high shrubbery of the wax-flower, *Eriostemon angustifolius,* which had never been recorded for the area; a few pale pink flowers were already open. At the opposite end of this reserve (near Kingower) grows another but extremely rare member of the same rue family, viz. *Zieria aspalathoides* — apparently its last stronghold in Victoria, if the term "strong" be really justified because only half a dozen bushes are known to exist here. Some monoliths along the spur are as big as houses, often with a jumble of passage-ways between and beneath. Ancient eucalypts, chiefly Red Stringybarks and Long-leaf Boxes, grow virtually out of the rock which they have succeeded in splitting apart by immense and sustained root pressure. On the bark of one dead box we found excellent fruiting material of an unusual, putty-grey crustose lichen which proved to be a species of *Ochrolechia.* Eastern slopes carried pure stands of Wallowa (*Acacia calamifolia*), little umbrella-like trees with dense, rather flattened crowns reminding one of the more restricted Currawang (*A. doratoxylon*) on similar granite hills around El Dorado, in N.E. Victoria. Wallowa is also abundant to the south and south-east of Melville Caves.

Sunday morning gave time enough to visit the huge jumble of monoliths, comprising the highest point of Melville Caves, and the lookout point about 2 km to the south; we ascended via the western spur where an intriguing crevice form of the bluebell, *Wahlenbergia stricta,* bore both globular and narrowly cylindrical capsules on one and the same plant! Could it have been of hybrid origin? One saw with dismay a growing gallery of spray-painted graffiti that now defaces several big tors — supervision by a resident ranger would seem to be the only solution to such vandalism.

Since flowering is minimal at this season, botanical attention was concentrated throughout on the cryptogams. It was rather surprising to find at least 25 different agarics about at the end of June, not to mention 13 other larger fungi and 14 species of moss. Two earth-star species (*Geastrum*) were noted, while the spongy dark-haired bracket fungus, *Tyromyces pelliculosus,* was collected from a living trunk of *Eucalyptus macrorhyncha* at southern lookout. All told, the flora of Mt. Kooyoora — Melville Caves reserve is neither rich nor colourful (except for wattles in their season). Of the 155 species of indigenous vascular plants recorded to date, 24 belongs to the daisy family (*Asteraceae*); at least 48 kinds of aliens are naturalized, principally grasses and thistles.

4. Howqua River (26-28 January, 1985)

At last Australia Day week-end, arrival and departure times varied somewhat, but over the whole period about 33 participants of this second summer camp-out, by the F.N.C.V., were under canvas at Sheepyard Flat on the Howqua River. The Flat proved to be such a popular holiday venue for others than naturalists that we had plenty of neighbours, including a few rowdy trail-bike exponents (who were later ordered to move out by custodians of the law). Indeed, every grassy flat along the Howqua, up-and down-stream, had its complement of tents and vehicles.

Saturday was our big walk, up to The Bluff from a convenient point at its western base whither we'd been ferried by car on well graded forest roads. The very steep ascent followed the northern edge of a recent light burn (of about 1000 ha.), that had involved part of the summit plateau. About half way up we had to negotiate a cliffy section where the shaded moist recesses beneath a sandstone ledge supported excellent colonies of the sparsely ranging mountain fern *Cystopteris filix-fragilis*. Drifts of white around lower grassy spots proved referable to the Chamomile Sunray (*Helipterum anthemoides*), two common grasses being *Agropyron scabrum* and *Deyeuxia frigida*. Mauve blooms of *Epilobium gunnianum* (a mountain willow-herb) were conspicuous in boggy places around springs.

Eventually we emerged through flowering clumps of dwarf snow gum (*Eucalyptus pauciflora*) onto the edge of the abrupt scarp and the plateau top beyond (Fig. 2). What a feast of floral colour met the eye! White heads above silver foliage of *Helipterum albicans* subsp. *alpinum* in abundance (Fig. 3), gold of other composites (*Craspedia 'glauca'* agg., *Podolepis robusta, Senecio lautus, Microseris scapigera* and a fine-leaved variant of *Helipterum albicans*), blues of *Brachycome scapiformis* and *B. rigidula*, purple of trigger-plant spikes (*Stylidium graminifolium*). Bushes of large headed

Fig. 2. The Bluff (near summit), Victoria

Pimelea ligustrina and *Prostanthera cuneata* were heavily in bloom along the plateau edge.

The apparent absence of some widespread alpines was curious, notably *Helichrysum acuminatum* (Orange Everlasting), heath species being also few and far between. Perhaps the limited area of flat terrain and a general water deficiency (only one small moss-bed on a north-eastern shoulder) were contributing factors. An obvious continuing degradation of the soil in moister hollows could stem from trampling by cattle. We noted a dozen kinds of native grass, e.g. *Poa hiemata, P. costiniana, P. fawcettiae, Deyeuxia brachyathera, Agrostis aemula, A. venusta, Danthonia alpicola* and *Stipa nivicola*, but very few sedges indeed (? too dry).

Fig. 3. *Helipterum albicans* subsp. *alpinum*

Lunchtime on the highest point at 1745 m (5650 ft.), comparable with Mt. Howitt not far to the east, afforded a marvellous view in all directions; down in a head of North Jamieson River the recent fire was still smouldering ominously. One delight in a grassy sward near the top was a small colony of Swan Greenhood orchid (*Pterostylis cycnocephala*). A late afternoon descent — about 400 m vertically — returned us in quicker time to our vehicles parked at the end of Eight-mile Gap road. Snow gums here attained maximum size, massive trees to 20 m tall. In adjoining taller forest of Alpine Ash (*Eucalyptus delegatensis*) were occurrences of Elderberry Panax (*Polyscias sambucifolia*), Tree Bitter-pea (*Daviesia mimosoides* var. *laxiflora*) and herbaceous *Pelargonium australe* flowering in cracks along rock slabs and mossy ledges. The Bluff, above its 1350 m contour, had shown us 110 species of vascular native plants.

Sunday's outing to the Lickhole Creek led initially downstream along the south bank of the Howqua, past a small clump of the locally rare *Banksia marginata*, then past the historic, square, brick blast furnace chimney (functional in the gold-mining days from 1882 to '85) to Fry's clearing whence we climbed steadily southward, over a high ridge into the deep Lickhole valley. The objective was a crag known as Castle Rock, towering above the creek; but after a hot, very steep scramble we came out too far down-stream and voted to stay put for lunch. There were enticing pools where we washed off the grime and cooled ourselves deliciously among tree-ferns (*Cyathea australis*), Banyalla (*Pittosporum bicolor*) and Woolly Tea-tree (*Leptospermum lanigerum*). Thus refreshed, one felt better able to tackle those interlacing thickets of tough-stemmed Mountain Correa (*C. lawrenciana*) lining the creek cliffs. Above them, as the gradient began to even out, were more open groves of *Lomatia fraseri, Grevillea alpina, Spyridium parvifolium* and an occasional trim treelet of *Oxylobium ellipticum. Eucalyptus* species were two peppermints (*E. radiata, E. dives*) and two white-barked gums (*E. mannifera, E. rubida*). Several native cherries or ballarts (*Exocarpos cupressiformis*) of the understorey attained immense size (to 13 m tall) and must have been quite old. On higher slopes the little boronia (*B. nana* var. *hyssopifolia*) was found in bloom.

The final, half-day excursion was to Mt. Timbertop. Cars were left at Red Hill saddle (on the Merrijig road) whence a very steep track leads up the western spur through messmate, peppermints and beautiful mountain gum forest to old twisted snow gums just below the summit ridge.

Blue daisies and yellow everlastings covered the reddish terraces of old conglomerate rock. Up to here, as elsewhere over the week-end, Eddie Mitchell had shouldered a large square box containing

his heavy load of photographic equipment; one hopes the results fully justified such noble effort. It had been intended to visit Rhyolite Falls on a N.W. gully-head of Mt. Timbertop, but here again we were defeated — the track, shown on several maps, had apparently been obliterated since more recent bushfires and the resulting heavy scrub. For the Lickhole and Howqua valleys near Sheepyard Flat a total of some 166 species of flowering plants and ferns had been tallied, but not many were still in bloom at the end of January. During our three days in the field Arthur Thies laboured unremittingly among the humble bryophytes; he collected and identified 74 species of moss and 13 hepatics, half of the mosses being new records for the County of Wonnangatta. Disappointingly, he failed to locate any species of the rather primitive, rock-loving genus *Andreaea* (small reddish-black cushions) that one would have expected to inhabit The Bluff.

Another splendid and quite rewarding camp-out.

5. Creswick (8-10 June, 1985)

Creswick, 17½ km north of Ballarat and with rainfall of 725 mm, is based on sedimentary rocks (sandstones and slates interveined with quartz) of Ordovician age. Alluvium covers much of the lower ground, and northwards the older rocks are overlain by sheets of lava belonging to the Newer Basalt series. Some volcanic rocks may be as young as 100,000 years, especially those of bald scoria cones that dot the plain as in other parts of the Western District — "mammeloid hills" Mitchell termed them when passing through the district in September 1836. Gold was discovered on Creswick Creek in Sept. 1851; but after the nuggets and easy surface gold were virtually exhausted, by the 1870's, miners followed the beds of old river systems out under the basaltic capping for distances up to 10 km. Vertical shafts to more than 160 m deep were sunk at great expense through solid basalt to reach the payable wash-dirt beneath. The Berry group of deep-lead mines proved fantastically rich — 387,314 oz. of gold, were taken by the Madam Berry Company alone.

But in the end it was water seepage that made recovery of the precious metal uneconomic. Even the gigantic, powerful Cornish beam-pump failed to keep shafts and their long drives dry and safe for this type of mining; Berry United Company was the last mine on the plains to close down, in 1902. The total (recorded) amount of gold from all the deep leads around Creswick had been 1,697,500 oz. — surely one of the world's most productive fields.

What of the vegetation? It is said that, when mining peaked, the naturally forested hills between Ballarat and Creswick were quite denuded, to supply the insatiable demand for firewood, poles, pit and prop timbers to shore up the mines. The biggest and oldest trees one finds in the bush today are but part of regrowth during the past century; but not many native plants were permanently lost to this area through mining. On the other hand, basalt grasslands have been drastically changed over the 140 years of intensive grazing and cultivation, with concomitant invasion by hordes of alien grasses, clovers, thistles and other aggressive weeds; only in such refugia as roadside and railway verges, also along a few creek gorges, is there an adumbration of the original plant communities. Even so, 125 native species have been reliably recorded from this basaltic tract during the last half century; a few of the shrubby kinds are now both extremely rare and endangered, e.g. the Austral Anchor Plant (*Discaria pubescens*) that Major Mitchell first saw here and upon which he commented in his journal entry for 27 Sept. 1836.

The first collector of Creswick plants was apparently Rev. W. T. Whan of Skipton; in the early 1860's he sent samples of about 60 species to Baron Von Mueller. These are housed at Melbourne Herbari-

um and several have never been found this century anywhere near Creswick where they are now presumed extinct, viz. *Muehlenbeckia cunninghamii, Gypsophila tubulosa, Ranunculus robertsonii, Euphrasia collina* and *E. scabra.* Indeed, at least 16 species (half being orchids) that were noted in the Creswick bush during the early 1930's — by the late R. W. Bond and the present writer — have never turned up again. Probably they were "on their last legs" 50 years ago, and obliteration of habitat by the subsequent large-scale plantation of pines has unfortunately finished them off.

A most interesting feature of Creswick used to be the luxuriant growth of ferns on the damp shaded walls of the mine shafts; at least 14 species (including two water-ferns and three filmy-ferns) were restricted to this man-made habitat, and it is perhaps ironical that the deliberate efforts of man have also been responsible for the demise of most species — a municipal campaign to fill in all shafts near the township that were considered dangerous to the unwary. The reader is referred to an article on this subject by R. W. Bond in *Vic. Nat. 50:* 208-213 (Jan. 1934), also *59:*133-134 (Dec. 1942).

Floristics of the Creswick environment — i.e. within a radius of 10 km from the Town Hall — is now well documented, thanks to the efforts of successive botanical observers at the Victorian School of Forestry, the late Mr. Allan Sonsee of Springmount and (more recently) members of the Creswick Field Naturalists Club. Some 450 species of native vascular plants and about 200 naturalized aliens are on record for the area thus circumscribed.

So it was to this fruitful historic region that the last camp-out was directed on Queen's Birthday week-end. Four half-day excursions were planned to fill in the time available. Camp was set up early on Saturday afternoon under sheltering pines at the Creswick caravan park, situated against Calembeen swimming basin. Here we were fortunate in having the wonderful co-operation of local naturalist Albert Perry, who camped beside us, and had a continual supply of hot water from his large iron fountain (hanging on a sturdy tripod over one end of the efficient campfire). Albert's detailed knowledge of district history and mining developments added much to the enjoyment of all ten participating campers.

The introductory short ramble was through the old Park Lake Reserve (once dignified by the title of "botanic garden"), containing some old mature Douglas firs and other conifers, to Lady Peacock pine plantation (replaced after being largely burnt out in the severe bushfire of January 1977), then northward to Quartz Hill which most locals knew under its more exciting alias of "Cut-throat". Here a deep shaft at the summit meets a horizontal drive from the northern base; we walked into the tunnel, but missed the swarms of big gnats that inhabit such cool dark havens in the heat of summertime. We'd like to have climbed Spring Hill too, but time didn't permit; so, from nearby tiny Smoky Town, we came down into North Creswick along King Street, admiring a few large Yellow Box trees (*Eucalyptus melliodora*) that caring residents had retained on their properties. Three lady naturalists from Clunes and Albert Perry took part in this first outing.

Next morning we "did" Koala Park, Humbug Hill, Cabbage Tree and Slaty Creek near its confluence with Mopoke Gully — lovely names. Failed to see any koalas; nowdays there are probably more of them outside the fenced enclosure than within it. Nor did we succeed in locating two very rare plants known at this spot: *Grevillea parviflora* and *Boronia nana* var. *hyssopifolia* — perhaps they too have now vanished from Creswick? Humbug Hill consists of a capping of old river-worn quartz boulders (occasionally 1 m across) above a great depth of white clay that has been extensively removed by Selkirk & Co. of Ballarat for high quality bricks and tiles. This plateau deposit supports a very

interesting heathland type of vegetation surrounded by messmate-peppermint-candlebark forest on the slopes. Here one finds, among the big quartz pebbles, three ferns that are confined (in Creswick district) to a few such cappings, viz. *Lindsaea linearis, Gleichenia microphylla* and *Schizaea bifida.* Fortunately Selkirk's excavation has not quite eliminated these intriguing items; selvages of the localized *Casuarina littoralis* and *Banksia marginata* have also survived. *Leptospermum myrsinoides* is more widely distributed as a heathland shrub of the district, but *Brachyloma ciliatum* (a small heath) is locally uncommon. From the S.W. slopes of Humbug Hill we were soon in Cabbage Tree (named from the headgear of early Chinese gold-seakers); once a township with separate school, it now consists of only four occupied houses. Mopoke was a hamlet too, with its own store and pub, but not even *one* building remains; we saw the single ancient Stone Pine (*Pinus pinea*) in a grassy clearing where Creswick's painter Allan T. Bernaldo had formerly lived (1900-13). Mention of the even more renowned Lindsay family of artists is hardly necessary; they are Creswick's most famous gift to the world. This part of the district has been sculpted into quartzy mounds and intervening ditches from extensive sluicing by means of an ingenious system of water races that once tapped off the higher reaches of Slaty Creek.

Then back to camp for a late lunch, followed by an inspection of the School of Forestry grounds, where a valuable arboretum of native and exotic trees has been built up since the school began in 1910 — it was the original Creswick Hospital, established in 1862, and the old facade is of considerable architectural interest. In the same grounds lies the red-brick Tremearne House, now housing a series of classrooms and laboratories but initially the imposing home of the old hospital's resident medico, Dr. John Tremearne who built it in 1884. Above the School of Forestry we followed a track out to Brackenbury Hill, one of the highest points around and furnished with an arrowed steel dial that shows the direction and distance of all major peaks within a sweep of almost 360°. We returned via Port Phillip road and a plantation firebreak to Oak Gully, then past the State Forest Nursery with just enough daylight to appreciate the colourful crops of large Fly Agarics (*Amanita muscaria*) — brilliantly scarlet to orange toadstools, introduced and with an unenviable reputation for narcotic poisoning.

On Monday, 10th June, the final jaunt was by car to the southern foot of granitic Mt. Beckworth, 19 km across the plains west from Creswick. Aborigines knew the place as *Nananook* ("behind"); what a pity that such a musical name has been superseded. We walked through a small plantation of pines, then worked our way among mossy granite boulders up to the summit (640 m) where a solitary, large, mop-headed Monterey Pine stands out as a land-mark for 20-30 km around. Another delightful panorama in all directions, involving those "mammeloid hills", as well as lofty Mts. Alexander and Tarrengower to the north-east. The crest of Beckworth is noteworthy for its extensive slabs, crevices and venerable twisted trees of great age — *Eucalyptus viminalis* and *E. obliqua,* with smaller and less frequent *Banksia marginata;* scented Groundsel (*Senecio odoratus*) is conspicuous as a soft-woody shrubby perennial to 2.5 m.

There are 210 native plant species on record for Beckworth forest reserve, embracing eight eucalypts, 18 grasses, 14 lilies and 34 kinds of orchids — largely on a sandy flat skirting the N.E. foot of the massif where Featherheads (*Ptilotus macrocephalus*) still survive the destruction caused by sand extraction. Manna Gum (*E. viminalis*) woodland is dominant over most of this range, and many of the smaller ground herbs are either seasonal or restricted in this area. Over the whole winter week-end, we saw very few plants in bloom — surely good reason for returning to Creswick in spring or early summer.

Naturalist Note

A Report on the Sighting of Aurora australis

BY PETER CORCORAN*

The evening skies over south Gippsland had been cloudy for most of January. We were waiting for a clear moonless night, for we wanted to see the southern constellations, including the Southern Cross and its adjacent phenomenon, 'the Coalsack'. On the night of 28-29 of January 1985, we were doubly rewarded. Not only did the Cross shine in all of its glory, but as a bonus, the Aurora australis came to life.

We city people seldom see the stars in their full magnificence. The glare of metropolitan lights dominates nature. It prevents us from seeing that object in the night sky which Captain Cook named 'the Coalsack'. The famous navigator had learned his sea-faring skills on a collier, he knew what a coalsack looked like. When he saw this new dark hole in the sky, he gave it a familiar name.

'The Coalsack' is a cloud of gas of such density that it blots out the stars behind it. In the country, in this instance, Waratah Bay, in south Gippsland, it is clearly visible. (Or invisible ?).

We had time to appreciate the blackness of the 'Coalsack' and the brightness of the Cross, as they appeared to slowly rotate above us, as the earth turned. Even the small stars within the constellations were plainly visible, but they dimmed as the Aurora burst low in the southern skyline.

Our viewing point was near the head of Waratah Bay. From here there is an uninterrupted sweep of Bass Strait, between the low headland of Wilsons Promontory, in the far distance, and the high land mass of Cape Liptrap, which is closer. This clear viewing arc of about 60 degrees of horizon gave us an excellent sighting of most of the phenomenon.

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The Aurora polaris, as both the northern and southern hemisphere lights are named, is caused by streams of electrical particles, which originate in sunspots. These charged particles join the ever present 'solar wind' and are attracted to the earth's magnetic poles. They interact with atoms of gas, mainly oxygen and nitrogen, in the earth's upper atmosphere. The result is analogous with the lighting of a television tube. We will not comment on the better program.

The Aurora is rarely seen from Victoria. This writer last saw it in 1954. It is so infrequent that no Government Department, State or Commonwealth, keeps a record of sightings. Even as far south as Hobart, occurrences are not common. They are usually noted as an addendum to other reports. One has to be in the high latitudes, such as Macquarie Island, to fully appreciate the splendor of the Aurora. Here, in one year, there were over two hundred displays. Most of these were quite minor, only about twenty were of the Aurora in its full magnificence.

Our sighting commenced in the early hours of the 29th of January (1985). It came initially as a pale green to white glare over the southern horizon. It covered an arc of about 70 to 80 degrees of the horizon and varied in height from 20 to 30 degrees above the waters of Bass Strait.

The density of the light changed rapidly, which created unfolding patterns. Then came the well known stabbing beams, as if from great searchlights. These streamers rose higher than the general area of light, perhaps to 30 degrees above the horizon. It is known that they reach a height of nearly one thousand kilometres above the surface of the earth.

These streamers drifted quite rapidly from west to east. They traversed the body of light in about ten seconds. Many faded

as they moved and others remained stationary before disappearing.

This display continued for an hour, then it lapsed. In place of the moving lights, there appeared a remarkable sight. A thin black crescent rose above the horizon. It extended across the area of light and was about 6 to 8 degrees high at the centre of the arc. It blotted out the glare behind it. The only visible light in the region of this dark narrow crescent was the flashing navigation beam on Citadel Island, off Wilsons Promontory. This stood out in front of the blackness.

The dark shadow lasted for about ten minutes, then it faded as rapidly as it had appeared. Again the Aurora's light commenced from the horizon of Bass Strait.

The cause of this black arc is a mystery. It was not a cloud bank. It was too regular and it came and went too rapidly. This writer's theory is that it may have been caused by a combination of factors of light at the polar ice-cap. This may have thrown a shadow of the curvature of the earth between Antarctica and Australia.

We continued to watch. The Aurora made the Southern Cross and the 'Coalsack' seem a small event by comparison. But these we have with us always.

Aurora australis is not so munificent to we Victorians.

Report on Labour Day Week-end Excursion to Mornington Peninsula March 9-11, 1985

In Melbourne, this Moomba week-end was one of the hottest on record, temperatures 31-33°, but the temperatures on the Peninsula were modified by the coastal breezes.

Fifty to sixty people attended the excursion which commenced on Saturday 9 March at Adam Clarke Village, Golf Links Rd., Baxter, where we were briefed by the President of the Peninsular Club, the Host Club, Mr Owen Dawson, and the Honorary Secretary, Mrs Alison Walker and then we proceeded to the Moorooduc Quarry via Two Bays Rd.

Mr Noel Hunt and Mrs Anne Read had prepared notes on the rocks which are of sandstone, slate and chert formed about 450 million years ago, before any vertebrate animals had evolved, but Graptolite fossils are found in the upper layers. The base rock has been metamorphosed into a very hard, erosion-resistant material forming a contact ridge which has become the watershed of the east and west flowing streams. We were able to see evidence of ancient orogenic and tectonic movement of these rocks in the steeply pitching anticline in the Middle Ordovician strata and on the west face an overfolded syncline and anticline (now rather overgrown with non-idigeneous *Acacia longifolia).*

The quarry section, (23 hectares) is the only one which has been designated as a Flora-Fauna Reserve by the Frankston Council in 1974. It provides a breeding habitat for 44 species of native birds and a declining mammal population. The brown antichinus, sugar glider and koala have deserted and the black-tailed wallaby is rarely seen. The swamp rats, echnidas, ringtail and brush-tail possums are still present. A ringtail possum and its nest were observed in a Cherry-Ballart *(Exocarpus cupressiformis).*

We next visited *Sweetwater Creek Reserve* just south of Frankston city, guided tours were led by the President and Members of the Council of the Reserve. In spite of the dry conditions a kangaroo apple *(Solanum aviculare)* was covered with bright violet flowers and the small creek was still flowing amongst stands of *Acacia melanoxylon, Acacia verticillata, Bursaria spinosa,* various melaleucas and Austral bracken *(Pteridium esculentum).*

The Annual General Meeting of the V.F.N.C.A. was held at Adam Clarke Village, Baxter, in the evening. Mr Alan

Monger (Benalla) vacated the Presidency and Mr Albert Perry (Creswick) was elected. Mr Hartley Mitchell showed his fine film on "Birds of the Peninsula" and Mr Alan Spillane showed his remarkable slides of "Spiders of the Peninsula".

On Sunday March 10th, the members first explored the Flinders off-shore reef off the Golf Links and learned that this is one of the finest reefs in south-east Australia. A large brown-red *Octopus australis* was filmed in a rocky pool, the undersurface of its tentacles being bright orange, its rapid colour changes were noted as it attempted to hide under the seaweed. Later two of the dangerous Blue ringed Octopus *(Hapalochlaena maculosa)* were found on the Shoreham reef and were treated with respect, it was alleged that some of the neurotoxin from this species had been absorbed through the skin of an attendant whose hands had been in the water of an aquarium in which one of these creatures had been kept. Brittle stars of several varieties (some with arms of up to 150 mms) were not uncommon on the underside of rocks or among bryozoas sponges or algal tufts at low tide on both reefs.

The National Parks Ranger then briefed us at the parking area on the Rosebud-Flinders Road opposite "Highfield" and led us via the new track to Main Creek and up a steep area through Banksia groves with prolific bird life to the Firebreak and the junction of Long Point track. Eventually we reached Highfield Bunkhouse for a picnic lunch. Some of the party walked to Bushranger Bay for a swim and lunch and were eventually picked up by the bus at Cape Schanck. A rest was taken from the heat of the afternoon at the Pines Picnic Area and the party proceeded back to Frankston via Arthurs Seat.

In the evening, Mr Geoff Weir, a Marine Biologist and underwater photographer, showed interesting slides of how coastal invertebrates survive.

Club reports were given as follows:

Bob Humphries, Stawell, reported that a mammal survey group had been formed to trap, weigh and measure and photograph and record mammals in the area; the results were sent to the Fisheries and Wildlife Division.

Tom Salt, F.N.C.V., Melbourne, reported work on surveying bats and that the Club had been requested by the M.M.B.W. to survey 600 acres of bushland re fauna and flora in the Springvale Rd area.

He also voiced his Club's concern that geology is no longer taught in the State Schools.

Mrs Leitch, President of the Benalla F.N.C. reported an excursion to Yea and the Granite Black Springs and the Mt. Sumaria region, the latter in conjunction with members of the Upper Goulburn F.N.C.

Also a camp at Wilson's Promontory in August 1984 and their preparations for the forthcoming Nature Show.

Mrs Argall, Maryborough F.N.C. reported that although the area had been devastated by the recent bushfires her Club would welcome the V.F.N.C.A. on October 5-6 and hoped to show them plenty of regenerating orchids.

Mr Albert Perry, Creswick F.N.C. reported that after the January 1985 bushfires and lack of rain they were perturbed about regeneration in eucalypts. The grey gums and iron barks had coppiced, but no others.

Marie Allender, F.N.C.V. Melbourne reported that fences had been burned around the Costick Reserve near Maryborough.

Mr Owen Dawson, President of Peninsula F.N.C. stated that there were 80 members who meet each month and had regular excursions on which they kept careful records because the area is undergoing servere population pressure. He mentioned that birds seem the most popular subjects and geology the least popular at present.

Alan Monger (Benalla) and Clarrie Handreck spoke on the Marine Research Group of Victoria and introduced us to

their latest publication in association with the Museum of Victoria, a handbook *Coastal Invertebrates in Victoria* which was on sale at the F.N.C.V. bookstall run by Helen Stanford at the meeting.

The following morning Monday 11 March, Labour Day, was spent inspecting the Shoreham Reef, where a conchologist, who has a shell museum near Frankston was present to identify specimens.

After lunch and a swim, thanks were rendered to the Host Club, Peninsula F.N.C. for an excellent weekend.

Elizabeth K. Turner M.D.

FIELD NATURALISTS CLUB OF VICTORIA

Reports of recent activities

General Meeting Monday, 8th July

The Speaker, Dr. Malcolm Calder of the School of Botany, Melbourne University was introduced by the President.

Dr. Calder began by speaking briefly about the Victorian National Parks Association's Nature Conservation Review of the nature conservation status of plants and animals in Victoria. Since the establishment of the Lands Conservation Council 10 years ago, large numbers of reserves have been created and there is at present a need to assess the status of species and evaluate whether adequate conservation is being achieved. The study is being funded by money from the estate of Miss Jean Blackburn and it is intended to produce a report and a book from the results.

Dr. Calder then moved on to his major topic for the evening, "The Reproductive Biology of Orchids". After an introduction on the structure and pollination of typical orchid flowers he outlined some of his recent research, particularly on the Rock Orchid, *Dendrobium speciosum,* the Metallic Sun-orchid *Thelymitra epipactoides* and Rabbit-ears, *T. antennifera.*

Dendrobium speciosum reaches the southernmost limit of its range in East Gippsland and is well adapted to fire and dry conditions. Although it produces a huge flowering spike, only 2-3% of flowers ever produce pods. As orchid pollen are transferred together in a mass called a pollinium, each flower has only one chance to pollinate another. The low success rate is due mostly to the self-incompatibility of *D. speciosum,* which means that a pollinium must be transferred to a flower on a different plant to achieve fertilization. As pollinating insects tend to move between flowers on one inflorescence before moving on to another, a large number of pollinations are incompatible and the flower yellows and falls in 10-14 days. Another factor which may be affecting the pollination rate is the presence of feral honey bees which are larger than native bees and tend to knock the pollinia from the flowers without transferring them. Thus, because only a small perrcentage of pollinia ever achieve successful pollination, it is an advantage for the plant to produce many flowers in order to maximize the number of pollinia available for transfer.

Thelymitra antennifera flowers in spring in heathlands along with a large number of other yellow flowering species. It produces no nectar and has no other obvious reward for its polinators which it attracts by deception. Pollinating insects attracted to the other yellow heathland plants by rewards of nectar and pollen frequently visit *T. antennifera* flowers by mistake. The pollinia then get stuck to their abdomen and transferred to the next orchid when the insect repeats its mistake. The pollination rate for this orchid is highest when only few of them are in

flower as the insects then are less likely to learn to recognize and avoid them.

Thelymitra epipactoides is a robust and beautiful species of heathland which has become endangered largely due to its being a favoured species with orchid collectors. This is another species which offers no reward to pollinators relying on deception to attract them. It displays a very wide range of colour variation which would seem to be an adaptive advantage in that pollinators are less likely to learn to avoid it.

Exhibits

— Under microscopes. The Bryozoans *Amathia bicornis, A. cornuta* and *A. brogniartii* sent in by Mary Doery from Western Port Bay. Volumes of the prodomus of the Zoology of Victoria from the F.N.C.V. library with illustrations of Victorian polyzoa and other fauna. Bright yellow nudibranchs *Archidoris* and *Doris* from Black Rock, one with an egg sac and a smaller *Doto* and its egg sac. Also from Black Rock some tiny sea spiders (Pycnogonids). (Mr. D. McInnes).

— Four species of Dynastine beetles (Scarabaeidae), from Rushworth and a green ant which was associated with one of the species. (Mr. I. Faithfull).

— An index to all references to birds in the first 100 volumes of the Vic. Nat. by Mr. Jack Hyett. (Dr. B. Smith).

General Meeting
Monday, 12th August.

Honorary Memberships were presented by the President to Miss Joan Forster and Miss Laura White.

Miss Forster's interest in the F.N.C.V. first developed after visiting the Club's 50th anniversary show in 1930 as a young girl. In later years she became a very active member of the Club and was involved with junior members. Miss Forster reminisced on her many happy memories of Club activities and the large number of notable naturalists she has known over the years.

Miss Gwynnyth Taylor then spoke on behalf of Miss White. Miss White has had a long and active involvement with the Club and has served as Assistant Editor of the Victorian Naturalist, Assistant Secretary and as a member of council and was particularly active in the Botany Group. Like Miss Forster, Miss White was a school teacher and had a big influence on many young people, encouraging them to appreciate their environment. Miss White thanked the Club and said that she was proud to be associated with a club like the F.N.C.V. which has encouraged governments to preserve our natural heritage.

The Speaker for the evening was Mr. Peter Gell who spoke on "Birds of Remnant Mallee Patches at Wedderburn". The work resulted from a study of 8 small patches of mallee near Wedderburn ranging in size from about 20 ha. to over 3,000 ha. and their associated bird populations and aimed to see whether the Island Biogeographic Theory, that the larger an island the more species on it, was likely to hold true in this situation.

The results indicated that whereas the numbers of species were very similar between the patches of mallee, when diversity was looked at there was a significant increase with increasing size of the patch.

The smaller areas of uncleared mallee had a lot of "fugitive" species, such as the Red-rumped Parrot, which spend a lot of their time on adjacent agricultural land and use the uncleared areas as a refuge.

Mallee dependant species, such as the Mallee Fowl, Gilbert Whistler and Scrub Robin required large areas of mallee to survive and the diversity of these species correlated very strongly with the size of the area.

The mallee forests at Wedderburn are the southernmost limit in the range of many mallee dependant species and the conservation of the largest patches is crucial to their continued survival in the area.

The smaller patches of mallee are, however, very important as corridors to aid in the migration of species between

(Continued from inside front cover)

Geology Group — First Wednesday.
Wednesday, 2nd October. (To be announced).
Wednesday, 6th November. (Mr. Bill Birch).
Wednesday, 4th December. (Christmas Members Night).

Mammal Survey Group — First Tuesday.
Tuesday, 29th October. (November Meeting). Big Desert Update.
Tuesday, 3rd December. "Swamp Wallabys". Mr. Ron Waters.

Microscopy Group — Third Wednesday.
Wednesday, 16th October. "Marine Life and the Microscope". Mr. Dan McInnes.
Wednesday, 20th November, "Movie Photography with the Microscope". Dr. E. Peters.

larger areas. At present a lot of the remaining mallee is under threat of clearing by prospectors and cutting for oil production. In creating reserves it is important to try to maximize the area unbroken by such disturbances and to understand the requirements of various species so that the best management strategies can be determined.

Exhibits

— Under microscopes: Sea Silk (*Amphibetsia operculata*), a collonial hydroid from Western Port Bay sent in by Mary Doery; a section of Limbergite Basalt from a quarry at Pretty Sally Hill. (Mr. D. McInnes).

— Under microscopes: botanical sections of the stems of various plants by Cliff Nance. (Mr. U. Bates).

— Plants from northern Australia: *Dendrocnide excelsa* (Urticaceae), the Large-leaf Stinging Tree and *Buckinghamia celsissima* (Proteaceae), a rainforest tree which grows well in Melbourne. (Mr. W. Ashburner).

— Some slides of plants and animals were then shown by Dr. Brian Smith. The Museum of Victoria is at present putting thousands of natural history slides onto a video disc for public access information. Volunteers were called for to help with the writing of data sheets for the slides.

Natural Notes

— There seems to be a late flowering of native plants this year, particularly noticeable with the Acacias. (Mrs. S. Houghton).

— The general feeling in the S.G.A.P. is that most wildflowers are coming out 2-3 weeks late this year (Miss. G. Taylor).

— A lot of Argentine Ants around the house lately. Why is it that they are not so bad in summer? (Mr. U. Bates).

— Pardalotes and Rosellas seen in Ormond.

— Sulphur-crested Cockatos in a cypress tree in Canterbury. (Miss M. Potter).

— Galahs eating Onion Weed bulbs at Pt. Cook. (Miss G. Taylor).

— Evidence of Wombat activity in the snow at Lake Mountain (Mr. W. Ashburmer).

FNCV LIBRARY

Members are invited to forward suggestions for additions to the Club library to the Librarian. Please make sure you include the full name, author and publication details of the books you mention.

Special Note for Authors Using Wordprocessors

The editors of the Victorian Naturalist are investigating the possibility of translating manuscripts directly from wordprocessing discs to the typesetting machine without rekeying by the typesetter. If this can be done, there is a potential for considerable savings in printing costs, as it would be much faster and would eliminate the possibility of typographical errors.

If your next paper for Naturalist is to be entered on a wordprocessor, please contact Russell Thompson (45 1594, 17 Powlett St., Heidelberg, 3084), for information relating to the compatability of your discs and the method of preparing copy for this purpose.

Field Naturalists Club of Victoria

In which is incorporated the Microscopical Society of Victoria

Established 1880

Registered Office: FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

OBJECTS: To stimulate interest in natural history and to preserve and protect Australian fauna and flora.
Members include beginners as well as experienced naturalists.

Patron:
His Excellency Rear Admiral SIR BRIAN S. MURRAY, KCMG, AO.

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MEMBERSHIP

Membership of the F.N.C.V. is open to any person interested in natural history. The *Victorian Naturalist* is distributed free to all members, the club's reference and lending library is available and other activities are indicated in reports set out in the several preceding pages of this magazine.

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FNCV DIARY OF COMING EVENTS

GENERAL MEETINGS

Monday, 9th December, 8.00 p.m.

Mr. Michael McBain. "The Victorian Underworld: A Natural History of Caves."
No meeting January.

Monday, 10th February, 8.00 p.m.

To be announced.

FNCV EXCURSIONS

Sunday, 12th — Sunday 19th January. Hobart. See last Naturalist for details or contact Marie Allender on 527 2749. Please forward final payments.

Saturday, 25th — Monday 27th January. Alpine campout. Leaders: John Milligan and Jim Willis. Probably to the Baw Baws. Contact John Milligan (45 Affleck St Wandong, 3656 — no phone yet) or Will Ashburner (890 7370) A.H.

Sunday, 2nd February. Mornington Peninsula, hopefully to include Portsea. Coach leaves Batman Ave. at 9.30 a.m. Fare $10. Bring picnic lunch.

Friday 7th — Monday 10th March. Eurobin Creek - Mt. Buffalo area. The VFNCA weekend will be held at Noonameena Lodge at the base of Mt. Buffalo. Very comfortable accommodation with all meals included. Cost $135 including coach for the four days (based on minimum 20 persons) Deposit $20. If going by private vehicle accommodation can be booked at the Lodge or a campsite on the property. Campsites $4.50 and caravan sites $6.50 per night. Meals can be provided if booked by mid-February. Bring binoculars.

GROUP EXCURSIONS

All FNCV members and visitors are invited to attend Group Excursions.

Mammal Survey Group
Thursday 26th December 1985 — Wednesday, 1st January 1986. The Grampians.
Saturday, 25th — Monday, 27th January 1986, Heathcote.

GROUP MEETINGS

All FNCV members and visitors are invited to attend Group Meetings

Day Group — Third Thursday.
No excursions in December or January.
Thursday, 20th February. Half Moon Bay.
Black Rock. Leader: Marg. Wilson (836 3521)

Botany Group — Second Thursday.
Thursday, 12th December. Annual Meeting and Members' Night.
No January Meeting.

Geology Group — First Wednesday.
No January Meeting.

Mammal Survey Group — First Tuesday
No January meeting.
Tuesday, 4th February. "Swamp Wallabys" Mr. Ron Waters.

Microscopy Group — Third Wednesday
No December meeting.
Wednesday, 15th January. Members' Night.

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Cover Illustration: Wilsons Promontory — Norman Bay from Mt. Oberon. Photo: courtesy National Parks Service.

The Burrow Habitat of Two Sympatric Species of Land Crayfish, *Engaeus urostrictus* and *E. tuberculatus* (Decapoda: Parastacidae)

By P.H.J. Horwitz,* A.M.M. Richardson* and A. Boulton†

Introduction

Recent work on freshwater crayfish in the Bassian region of Australia has indicated that some species, when in sympatry, divide the habitat finely according to the local topography. For instance, at sites in north west Tasmania where the ranges of *Engaeus fossor* (Erichson, 1846) and *E. cisternarius* Suter 1977 overlap, the former is found in the flood beds of creeks while the latter species occupies the banks (Suter and Richardson, 1977). The distance between the nearest burrows of the two species may be less than one metre, well within the potential range of movement of animals of both species.

In the Dandenong Ranges, east of Melbourne, *E. quadrimanus* Clark 1936 and *E. victoriensis* Smith and Schuster 1913 co-occur in the lower reaches of the creeks (Riek, 1969), while in the slower-flowing headwaters *E. tuberculatus* Clark 1936 and *E. urostrictus* Riek 1969 are found together. Preliminary investigations in Sherbrooke State Forest in the Dandenong Ranges suggested that there was a microhabitat separation between the latter two species and the first aim of this study was to document their local distributions and the associated variation in various physical parameters.

The water in the burrows of several species of Australian freshwater crayfish has been shown to contain an assemblage of animals termed the 'pholeteros' by Lake (1977). The pholeteros in burrows of the Tasmanian crayfish *Parastacoides tasmanicus* (Erichson, 1846) includes cyclopoid copepods, syncarids, janirid and phreatoicid isopods, and amphipods (Lake and Newcombe, 1975; Lake, 1977). In Tasmania, Suter and Richardson (1977) recorded blind amphipods from the burrow water of *E. cisternarius* and janirid isopods in the burrows of *E. fossor*. However the pholeteros inhabiting the burrows of Victorian crayfish has never been listed. Our second aim was to describe and compare the pholeteros from the burrows of *E. tuberculatus* and *E. urostrictus*.

All freshwater crayfish seek shelter of some form and most of these animals are capable of burrow construction (Riek, 1969; Hobbs, 1981); in fact, Berrill and Chenoweth (1982) consider that non-burrowing crayfish do not exist. Hobbs (1942, 1981) proposed a system to classify the types of burrowing crayfish in North America; all three categories of crayfish in Hobb's scheme apparently construct burrows which connect either with the water table or with free water. In Australia, however, there is an ecological group of crayfish comprising some of the species in the genus *Engaeus*, that digs burrows or chambers on hill slopes without reference to the water table. Examples of this group are *E. cisternarius* (Suter and Richardson, 1977) and *E. tuberculatus*. This group cannot be placed in any of the above categories. Our final aim was to examine the burrow habitat of a species in this group and compare it to that of a species found in burrows associated with the water table.

Materials and Methods

Field work was conducted in the headwaters of Sherbrooke Creek, a second-order creek flowing through Sherbrooke

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Forest, 1600 ha of tall open forest in the Dandenong Ranges. The study site was situated in a gully where a slowly-flowing creek, 1-2m wide and up to 30 cm deep, meanders through a flood bed up to 8 metres wide in places. The vegetation of the gully and flood bed is characterized by tree ferns *(Dicksonia antarctica)* and some sassafras *(Atherosperma moschatum)* and corresponds to the vegetation group S1 of Gullan and Robinson (1980). The vegetation on the banks and hill slopes is dominated by mountain ash *(Eucalyptus regnans)* and is similar to the vegetation groups S2 and S3 of Gullan and Robinson (1980).

Most of the data were collected during June 1982. A transect 5 m in length and 2 m wide was pegged out at right angles to the flow of the creek, starting at the creek edge and stretching across the flood bed and up the bank. Locations of the burrows were precisely plotted with the local topography, allowing calculation of their vertical heights above the creek.

Careful excavations of each burrow within and immediately adjacent to the transect were made, noting the presence and shape of soil extrusions (chimneys) and the shape and arrangement of the burrow system as a whole. As soon as a suitable volume (>20 ml) of water was located in a burrow, an oxygen probe (Model 51A, Y.S.I., Yellow Springs, Ohio) was gently inserted into the burrow water. Burrow water temperatures were measured to the nearest 0.5 °C using a mercury thermometer and the pH of the burrow water was recorded using a Metrohm pH meter (Model CH 9100). The water was then taken back to the laboratory for examination of the pholeteros. The vertical height of the entrance of each burrow above the creek water level was measured together with its maximum vertical depth and the depth of the burrow water below the surface. Finally, the burrow system was excavated until all connecting openings had been explored and any crayfish in them had been collected.

Substratum Analysis

Ten samples of fresh chimney soil material were collected from burrows on the transect, using the same methods as Grow and Merchant (1980); 5 were from *E. tuberculatus* burrows and 5 from *E. urostrictus* burrows. Each air-dried soil sample was ground and sieved through a 2 mm mesh. A subsample of approximately 5 g of this air-dried soil was further dried at 110°C for 8 h to remove the soil water. The subsample was then burnt at 420°C for 8 h and weighed to estimate the organic content.

Particle size analysis was performed following a mechanical dispersion and modified Bouyoucos hydrometer method (Hutton, 1950). For the particle size analysis, the 5 samples for each species were combined and this combined sample was subsampled; this subsample was analysed and the result were expressed in terms of percentage sand, silt and clay fractions.

Oxygen concentration, pH and temperature of the creek water were measured and a sample of the creek substratum was collected from the creek bed. A sample of leaf litter was collected from the transect to determine if any organisms found within the burrows also occurred in the moist surface habitat.

Pholeteros and litter samples were transported to the laboratory in plastic bags. Each sample was live-sorted using a binocular microscope at a magnification of 12.5X.

Results

Species Distribution

Fig. 1 illustrates the locations of occupied burrows in the transect. *E. urostrictus* burrows occurred exclusively in the flood bed region of the creek, while *E. tuberculatus* individuals were only found burrowing in the bank. A third species of freshwater crayfish, an undescribed species of *Euastacus* (Morgan, 1983), occupied burrows at the junction of the bank and flood bed; however it was more commonly found in the creek itself in bur-

rows, hollows within logs or under rocks. An identical pattern of distribution was found when the site was re-examined in September 1982.

The depth below the soil surface of the water levels in the burrows, their maximum vertical depths and the vertical height of each burrow above the creek are shown in Table 1. There is a close correlation between the height of the *E. urostrictus* burrows above the creek and the depth to the water in them, suggesting that in these burrows the water depth is actually the depth of the water table. This implies that these burrows contain water of interstitial or water table origin.

The burrows of *E. tuberculatus*, on the other hand, end in water-filled chambers well above the water table and show no correlation between height above the creek and depth to burrow water. They apparently obtain their water from soil seepage or surface water runoff. This difference is further borne out by the fact that when the burrow water was drawn out of *E. urostrictus* burrows, the burrows refilled almost immediately, while *E. tuberculatus* burrows, once emptied, remained empty.

Table 1. The maximum burrow depth, depth to the water level in the burrow and vertical height of the burrow opening above the creek of *E. tuberculatus* (A) and *E. urostrictus* (B) burrows at Sherbrooke Creek.

Burrow Number	Burrow Maximum Depth (cm)	Water Level Depth (cm)	Vertical Height of Burrow (cm)
A 1	48	24	20
A 2	40	24	105
A 3	36	27	230
A 4	52	40	300 +
A 5	42	31	300 +
B 1	11	4	4
B 2	6	4	5
B 3	6	5	5
B 4	11	9	9
B 5	19	10	11
B 6	17	10	12
B 7	27	12	16
B 8	19	12	15

Soil Texture

Table 2 shows the different proportions of sand, silt, clay and particles over 2 mm in size in the chimney samples of both species, and in the creek. The creek bed sample had a comparatively high sand component. These observations are to be expected; the water flow in the creek will carry smaller particles of soil down stream, and the flood bed will also experience removal of smaller sized particles.

Table 2. Percentages of each soil particle size class in the chimneys of the burrows of the two species of *Engaeus*, and the soil of the creek bed.

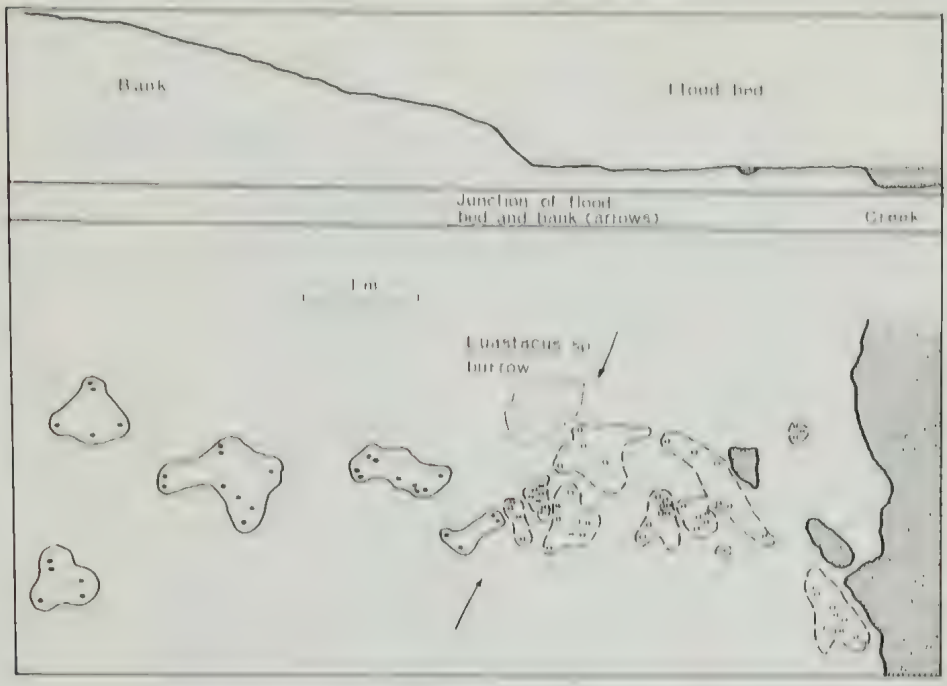
Particle size class (mm)	*Engaeus tuberculatus* chimney (%)	*Engaeus urostrictus* chimney (%)	Creek bed
< 2	3.3	4.5	8.6
2 – 0.02 (sand)	40.6	47.6	72.3
0.02 – 0.002 (silt)	21.3	18.1	11.8
< 0.002 (clay)	34.8	29.5	7.1

The analysis of the chimney soil revealed slight differences between the chimneys of the two species for each component: burrows in the bank contained a higher proportion of the finer particle sizes than those in the flood bed. The chimney samples can be classed as clay loam to silt loam, and they correspond to the general soils of the area which are described as krasnozems (Clifford, 1953), and which Edwards (1956) suggests are a result of thick clayey breakdown of acid volcanics (dacites).

Burrow Morphology

The burrows of the two species differ in gross morphology. *E. urostrictus* burrows have extensive lateral ramifications, often amongst buried and rotting vegetable matter, the matted roots of ferns, or the roots of shrubs and trees. These lateral tunnels open to the surface, often with

Fig. 1. The locations of occupied burrows of *Engaeus urostrictus* (on the flood bed) and *Engaeus tuberculatus* (on the bank) found on the transect. Each burrow system is represented by a group of dots (one for each burrow opening) bounded by the estimated extent of the system. The top figure presents a longitudinal transverse section of the transect.



chimneys up to 13 cm high constructed of pellets of soil (Fig. 2).

The lateral tunnels are found at what is presumably the mean water table level. A large burrow system can have several descending tunnels and may extend over half a square meter. These descending tunnels probably allow the crayfish to follow the rise and fall of the water table. At the base of these descending tunnels may be an enlargement or small chamber which is full of water for most of the year.

Chambers occupied by juvenile *E. urostrictus* were found once in June and once in September. Berried females were found only in December.

The burrows of *E. tuberculatus* consist of subterranean chambers with exit tunnels that diverge as they approach the surface. Just below the surface, each of these tunnels may divide again to form several openings for each chamber exit (Fig. 3). At each opening the soil is carried out in pellet form by the crayfish and deposited on the down-hill side of the opening to form a fan-shaped rim, unlike the chimney structures built by *E. urostrictus*. These rims of soil may be constructed in order to funnel water into the burrow or they may simply represent the most energetically efficient way of depositing the pellets.

Soil and Water Conditions

Table 3 compares the means and standard errors of physico-chemical parameters measured in the burrows of the two species and the creek. There are clear differences between the conditions in the crayfish burrows and those in the creek. The oxygen saturation and pH levels are higher and the water temperature is lower in the creek than in the burrows.

There were also significant differences

Fig. 2. A lateral view of a stylised burrow of *Engaeus urostrictus* from the flood bed.

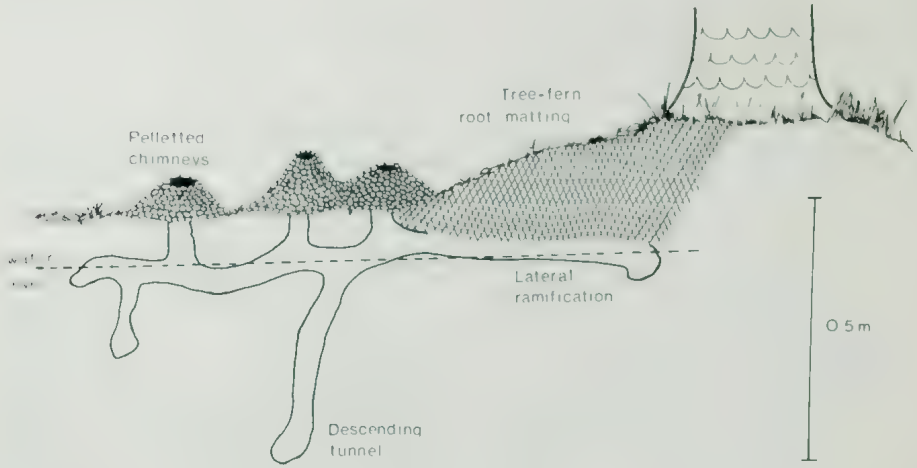
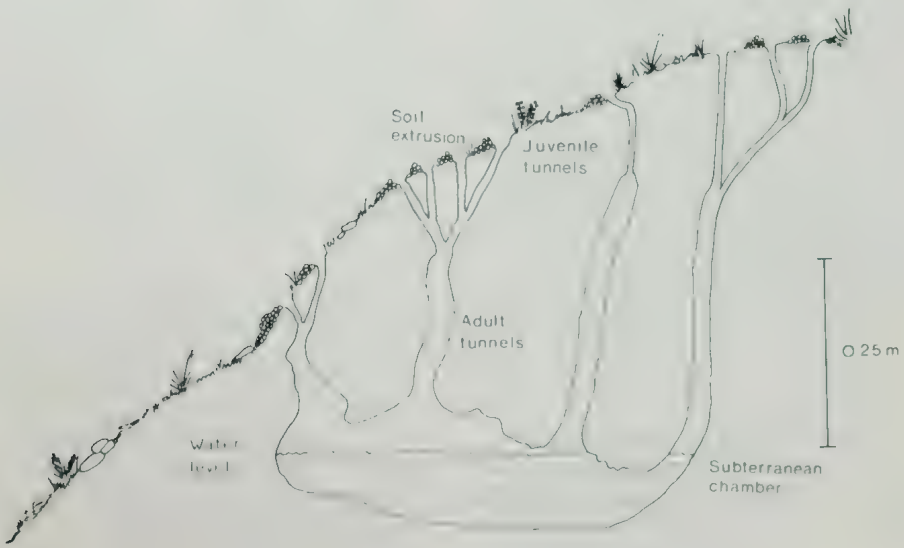


Fig. 3. A lateral view of a stylised burrow of *Engaeus tuberculatus*



in the chemistry of the water from the burrows of the two species. The pH of *E. tuberculatus* burrow-water was lower than that of *E. urostrictus,* and the water temperatures in the flood bed burrows were lower than those in burrows on the bank. The oxygen saturation levels were not significantly different.

The organic content of the creek bed substratum is much lower than that of the chimney soil from the burrows, but the organic content of the chimney soils for both species is similar to that described for the surface krasnozem soil of the Dandenong Region (Clifford, 1953). However, the burrows of *E. urostrictus* in the flood bed are located in soils with a significantly higher organic content than those of *E. tuberculatus* in the bank. The amount of organic matter being deposited by leaf and bark fall is likely to be similar on both the bank and flood bed, but the flood bed may also receive organic detritus from the creek. The soil of the flood bed is probably less stable than that of the bank which remains well packed. Overall, the soil of the flood bed might be expected to be more permeable to water than that of the bank.

Pholeteros

The fauna of the litter samples included nematodes, turbellarians, oligochaetes, molluscs, Acarina, Araneae, harpacticoid copepods, amphipods, Collembola, Dermaptera and the larvae of Diptera and Coleoptera. With the exception of the first three taxa, the harpacticoids and the Collembola, none of this litter fauna was recorded in the pholeteros and will not be dealt with further.

Table 4 lists the taxa collected in the burrow water of occupied and vacant burrows of *Engaeus urostrictus* and *E. tuberculatus.* Nematodes (probably several species) and cyclopoid copepods were present in all habitats. The cyclopoids were an undescribed species in the genus *Acanthocyclops* (D. Morton, pers. comm.). Ostracods and harpacticoid copepods (an undescribed species of *Antarcticobiosis,* R. Hamond, personal communication) were also common in the burrow water. Two specimens of the syncarid *Koonunga* sp. were recorded, one from a burrow occupied by *E. urostrictus* and one from an *E. tuberculatus* burrow.

Dipteran larvae of the families Chironomidae, Ceratopogonidae and Muscidae occurred in several burrows but may have been "fall-ins" because they were uncommon. A similar explanation is proposed for the sporadic occurrence of two taxa of coleopteran larvae.

Table 3. Comparison of the physico-chemical characteristics of the burrow water and soil of the two crayfish species, in June 1982. The mean values are presented, followed in brackets by the number of observations and the standard error, where appropriate. Tests of the differences between the means (T-test or Mann-Whitney U-test) are also included. Oxygen concentrations in mg/l were converted to percent saturation using the table given in Bayly and Williams (1973). The values recorded for Sherbrooke Creek at the same time are shown for comparative purposes.

	Engaeus tuberculatus	*Engaeus urostrictus*	Creek water
0_2 Tension (% saturation)	23.8 (5,4.62)	15.7 (8,2.30)	86.2
	$t_{11} = 1.59$, n.s.		
pH	4.98 (5,4.98)	5.91 (8,0.17)	6.4
	$t_{11} = 3.50$, $P<0.01$		
Temperature (°C)	6.6 (5)	6.0 (8)	5.5
	$U_{5,8} = 38$, $P<0.01$		
Organic Content (%)	8.38 (5,0.17)	9.76 (5,0.14)	2.5
	$t_8 = 5.33$, $P<0.01$		

Table 4 The pholeteros recorded from the burrow water of vacant and occupied burrows of the two crayfish species, showing the number of taxa in each habitat. The numbers of burrows examined in each class is shown in brackets.

Taxa	*Engaeus urostrictus*		*Engaeus tuberculatus*	
	Vacant (6)	Occupied (8)	Vacant (2)	Occupied (5)
Platyhelminthes:				
Turbellaria	-	1	-	-
Nematoda	1	1	1	1
Annelida:				
Oligochaeta	1	-	-	1
Arachnida:				
Hydracarina	1	-	-	-
Crustacea:				
Ostracoda	1	1	1	1
Cyclopoida	1	1	1	1
Harpacticoida	1	1	1	1
Syncarida	-	1	1	-
Isopoda	-	-	-	1
Insecta:				
Collembola	-	1	-	1
Diptera	1	4	2	2
Coleoptera	-	2	1	-
Total Taxa	7	13	8	9

There were no significant differences between the number of taxa in the vacant burrows and occupied burrows or between the number of taxa recorded from occupied *E. urostrictus* burrows and those inhabited by *E. tuberculatus*. No single taxon appeared to be especially numerous in any one habitat.

Discussion

The microhabitats occupied by *E. urostrictus* and *E. tuberculatus* differ considerably in Sherbrooke Forest (Table 5) and the differences are related to the location of the burrows relative to the local topography. Both species are permanent burrowers and this habitat partitioning can be expected to be maintained all year round.

Crayfish burrowing in the two habitats experience soils with different water-holding capacities. On the bank and hill slopes where *E. tuberculatus* constructs burrows, the water permeability through the soil ('interflow' *sensu* Williams and Hynes, 1977) is very low and we suggest that crayfish utilise this property of the soil by digging burrows whose chambers function as water reservoirs. The water in these burrows is derived from surface water run off and slight soil seepage. We observed these chambers to hold large quantities of water, up to 5 L in some cases.

On the other hand, burrows of *E. urostrictus*, which occur in soils with a higher water permeability, probably fill from the water table or interstitial water, since they are indirectly connected to the creek. Under these conditions, the burrows need only cater for the (usually minor) fluctuations of the water table. Thus the tunnels constructed by this species ramify laterally at the level of mean water table, but descending tunnels go to the lowest water table level.

In *E. tuberculatus* burrows, water in the reservoirs or chambers can exchange oxy-

gen with the comparatively large supply of air in the chamber, over a large surface area; consequently the burrow water should be well-oxygenated. However, on the flood bed where the volume of air in the burrow is low and the area of the air-water interface small, conditions might be expected to approach anoxia due to the high levels of organic materials in the soil. Such oxygen conditions would be similar to those described by Grow and Merchant (1980) in the burrows of *Cambarus diogenes diogenes* Girard 1852. The oxygen levels that we measured suggested these trends, but the differences were not statistically significant. This may have been due to the infiltration of oxygenated water from the creek into the flood-bed burrows.

The acidity of the burrow water might be expected to reflect the dissolved oxygen tensions. The creek water was less acidic than either the flood bed or bank burrow waters. The bank burrows, however show a more acidic water than those of the apparently more anoxic flood bed, perhaps as a result of the influence of the acid volcanic soil.

In spite of the marked physico-chemical and topographical differences of the habitats provided by the burrows of *Engaeus tuberculatus* and *E. urostrictus*, the common taxa comprising the pholeteros are the same. Although the burrow water may be derived from different sources for both species, no taxon in the pholeteros appears to be especially numerous in either burrow type in this study. There were no significant differences between the number of taxa in each burrow type, nor did occupied burrows possess a richer pholeteros than vacant *Engaeus* burrows.

Only nematodes, ostracods, cyclopoid copepods and possibly *Koonunga* sp. are true components of the pholeteros of *E. urostrictus* and *E. tuberculatus* in Sherbrooke Forest. No species lists of pholeteros from Victorian crayfish burrows are available for comparison, but the pholeteros of the burrows of the two *En-*

Table 5. A summary of the microhabitat differences between the two crayfish species. Oxygen saturation has been bracketed because the measurements did not show a significant difference between the burrows, however, the predicted trends (see text) have been included.

		Engaeus tuberculatus	*Engaeus urostrictus*
Local Distribution		Bank	Flood bed
Derivation of Burrow Water		Surface water runoff.	Interstitial water.
Soils: Organic Content		Low	High
Soil Texture		More Clay	More sand
Burrow Morphology		Many openings. Angled tunnels. Chamber or water reservoir.	Many openings. Lateral tunnels. No distinct water reservoir.
Physico-chemical Properties of Burrow Waters	Oxygen	(High)	(Low)
	pH	Low	High
	Temp.	High	Low

gaeus species in this study is depauperate compared to that found in the burrows of Tasmanian crayfish (Lake and Newcombe, 1975; Suter and Richardson, 1977).

Having demonstrated a clear microhabitat separation between these two species of crayfish, it is relevant to examine the phylogenetic relationships between them. In a taxonomic survey of the genus *Engaeus* currently being undertaken by two of the authors (PHJH and AMMR), it has been found that only small differences exist between the two species. In an electrophoretic isozyme study, using a total of 20 enzyme loci, the two species exhibited a fixed difference of only 5% at this site. Similarly, of 75 morphological characters, only five are fixed differences at Sherbrooke Forest. As the species are broadly sympatric at this site, these findings indicate that there is no interbreeding between the populations of each species, although the species appear to be very closely related. This substantiates the taxonomic status of both species and suggests that recent speciation has occurred.

There are very few descriptions of such small scale partitioning of the habitat by burrowing crayfish outside Australia. Hobbs (1981), in his compehensive treatment of the crayfish of Georgia, describes situations where primary burrowing (*sensu* Hobbs, 1942, 1981) species, e.g. *Cambarus (Lacunicambarus) acanthura* Hobbs 1981 and *Cambarus (Depressicambarus) cymatilis* Hobbs 1970, occur in very close proximity, but he does not describe any differences between the burrows or their local distribution. More recently, Hobbs (1983) has described small-scale partitioning between *Distocambarus (Fitzcambarus) carlsoni* Hobbs 1983 and *Cambarus (Jugicambarus) carolinus* (Erichson, 1846) in a South Carolina swamp where the partitioning is on the basis of the presence or absence of flow in the groundwater. Small scale habitat preferences in stream-dwelling North American crayfish have been described by Bovbjerg (1970) and Rabeni (1985).

In Tasmania, *Engaeus fossor* and *E. cisternarius* appear to partition the habitat in rainforest gullys in a similar way to the species described here (Suter and Richardson, 1977). In wet sedgelands in the south west of the state, *Parastacoides tasmanicus tasmanicus* and *P. t. inermis* are often found sympatrically, with *P. t. inermis* occupying drier sites, in which the burrows may lack free water during the summer (Richardson and Swain, 1980). Although there are no other published accounts of habitat partitioning in Australian crayfish, recent field studies (P.H.J. Horwitz, unpublished) suggest that there are a number of other examples awaiting description. The distinct partitioning described here may exemplify the pattern in other areas of Australia where crayfish species can be found in sympatry; this is being investigated.

Acknowledgements

We wish to thank Dr R. Hamond, Dr B. Knott and Mr D. Morton for the identifications of harpacticoids, syncarids and cyclopoids respectively, Ms B. Bowen for help in compiling the figures and Drs P.S. Lake, R. Swain and Mr A. Sokol for constructive criticisms of the manuscript. Dr Horton H. Hobbs Jr. made a number of helpful criticisms of the MS and supplied valuable information about North American crayfish. Field equipment was loaned from the Zoology Department, Monash University. Electrophoresis of crayfish tissue was carried out by Dr P. Baverstock and Mr M. Adams at the South Australian Museum. Permission to conduct field work in Sherbrooke Forest was granted by the Chairman of the Forests Commission of Victoria. The study was partly funded by the Australian Biological Resources Survey.

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MAMMAL SLIDE LIBRARY

Over the past two years the FNCV Mammal Survey Group has been establishing a slide library of native and introduced mammals of Australia, their tracks, signs and habitats. Members are encouraged to contribute to this collection, which has already become a useful educational and reference tool. Although many common species are already well represented in the collection, further additions, particularly of the less common species, juveniles, uncommon colour phases and habitats, would be appreciated. If you think you can help please contact Bertram Lobert (544 0607, 14 Marshall Ave., Clayton North, 3168). All slides will be well cared for, reproduced and returned to you as soon as possible. Contributions should be accompanied by the following information: species, date, locality, photographer and, where possible, habitat description. The project costs have been generously supported by the M. A. Ingram Trust.

Bertram Lobert,
Chairperson MSG.

FNCV COSSTICK RESERVE PLANT LIST

The vascular plant list for the FNCV's Cosstick Wildflower Reserve at Maryborough currently consists of 56 species. The list is being revised and two factors should contribute to its expansion: the burning of the reserve by wildfire last summer and the recent visit of the VFNCA. Records in the hands of members would be welcome and should be forwarded to the Hon. Secretary with the ultimate object of publication of an up-to-date record in these pages.

Extension of the Published Range of the Eastern Small-eyed Snake *Cryptophis nigrescens* in Victoria

By L. E. Conole*

The Eastern Small-eyed Snake *Cryptophis nigrescens*, a nocturnal and little known elapid, has only three times been recorded with certainty west of Melbourne in Victoria; on two occasions in the Brisbane Ranges and once at Toolern Vale. In late 1960 or early 1961, Trevor Pescott (pers. comm.) collected a *C. nigrescens* along with a Bougainville's Skink *Lerista bougainvillii* from under a sheet of iron in heath/open-forest near the Ballan-Geelong Road/Switch Road intersection. The author observed one in the Anakie Gorge on 6 April 1985. Ron Waters (pers. comm.) photographed a large specimen near Toolern Vale in the mid-1970's.

Cryptophis nigrescens can be distinguished readily from the two other small elapids in the Geelong area, the White-lipped Snake *Drysdalia coronoides* and the Little Whip-snake *Unechis flagellum*. *D. coronoides* as its vernacular suggests has white lips and dorsally it is light brown with a sometimes reddish-orange ventrum, whilst *U. flagellum* is a very small, black-headed, reddish-brown snake. *C. nigrescens* in contrast is black dorsally and whitish ventrally, and has a distinctively squarish head in comparison with other small, local elapids. None of these species appear to be sympatric locally. *D. coronoides* is restricted to the higher rainfall heaths and tall open-forests of the Otway Ranges south-west of Geelong, and *U. flagellum* whilst probably present in the Brisbane Ranges, seems to occur in very open habitats such as farmland and savannah woodland (Schulz, 1985). However, Peter Robertson (pers. comm.) has found *C. nigrescens* and *U. flagellum* together in north-east Victoria, and there may be some overlap in the Brisbane Ranges. The only large elapid which seems to be sympatric with *C. nigrescens* is the Eastern Brown Snake *Pseudonaja textilis*, although the Copperhead *Austrelaps superbus* and the Common Tiger Snake *Notechis scutatus* probably occur in parts of the Brisbane Ranges. The Red-bellied Black Snake *Pseuedechis porphyriacus* is recorded for the Brisbane Ranges once only by a roadkill in the Durdidwarrah area (R. Waters, pers. comm.), but is better known from the nearby Werribee Gorge (T. Pescott, pers. comm.).

The recent observation of *Cryptophis nigrescens* at Anakie Gorge was made approximately 2.5 hours after dark at 21:30 hours on 6 April, 1985. The prevailing weather conditions were overcast, calm and mild with an ambient temperature of approximately 18 degrees Celsius (the temperature in Geelong at approximately 01:00 hours was 18° C. The habitat upslope from the track is heath/open-forest dominated by Brown Stringybark *Eucalyptus baxteri*. Downslope there is dense saw-sedge *Gahnia* and sword-sedge *Lepidosperma* beneath Woolly Teatree *Leptospermum lanigerum* in a mesic microenvironment below the wall of the Lower Stony Creek Reservoir. The snake was in the centre of a metre wide track when it came to my attention as I shone the spotlight on the ground to assist other members of the party to negotiate the slope.

The normal distribution of *Cryptophis nigrescens* is to the east and north-east of Melbourne (P. Robertson & J. Coventry, pers. comm., Rawlinson, 1965) the two records from the Brisbane Ranges and the one from Toolern Vale constitute a slight extension in the published range of the

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species. The population in the Brisbane Ranges is possibly quite restricted and the animals locally rare or uncommon, but the secretive, nocturnal habits of *C. nigrescens* could account for the scarcity of records. Pescott's 1960-61 location is about two kilometres from Anakie Gorge and both areas are adjacent to Switch Road.

Cryptophis nigrescens appears to be primarily lizard-eating and nocturnal, although known to be partly diurnal in rainforest (Cogger, Cameron & Cogger, 1983) and on overcast afternoons (Shine, 1984). In an analysis of the diet of *C. nigrescens* and the Northern Small-eyed Snake *C. pallidiceps* Shine (1984) found that 89% of the stomach contents were scincids and 5% were snakes. He also found one agamid, one pygopodid and two lizard eggs, but no gekkonids. Two snakes were carrying a frog in their mouth at the time of collection. The fact that the greatest proportion of the diet of *C. nigrescens* and *C. pallidiceps* was diurnally active skinks suggests that *Cryptophis* species, in common with other small, nocturnal Australian elapids, forage noctur nally for inactive skinks (Shine, 1984).

Acknowledgements

I would like to thank Grant Baverstock, Col leen O'Meley and Serena O'Meley who accom panied me in the field when the recent obser vation was made.

My thanks are also extended to Geoff Brand, Peter Robertson, Trevor Pescott, Rick Shine and Ron Waters for their helpful comments on a draft of this paper; and John Coventry, Peter Robertson, Rick Shine and Ron Waters for their assistance with records and references.

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LAND CONSERVATION COUNCIL EAST GIPPSLAND AREA REVIEW

The LCC East Gippsland Area Review study report (for sale at the State Government bookshop at a price of $8.00) was released for public comment in August. It is intended that a Club submission will be made when the Proposed Recommendations are released, probably early in 1986, but to do this the input of members is required. Those with a knowledge of the area of an interest are invited to contact either Mr. Will Ashburner (890 7370 A.H.) or the undersigned to discuss possible contributions. Written material would be most welcome.

Ian Faithfull,
Hon. Secretary.

MISSING ISSUES

The Club has recently received an unexpected donation of virtually the entire series of The Victorian Naturalist, Volumes 1-100. There is but one missing issue, Vol. 70 No. 4. If anyone has unwanted copies of this issue it would be a great service to the Club to complete the set. Please address any donation to the Hon. Secretary, FNCV, at the Herbarium.

Seed-eating Bugs (Hemiptera: Heteroptera: Lygaeidae) at Wilsons Promontory

By Alan N. Andersen*

Lygaeid bugs (Fig. 1) are small to medium sized (generally 2-6 mm) insects with sucking mouth-parts that are found throughout the world. Most species are phytophagous and many feed upon seeds, either while the seeds are still developing on the plant or when they have fallen to the ground (Cremer, 1966; Malipatil, 1979; Sweet, 1960). Seed-eating is especially prevalent in the sub-family Rhyparochrominae, which contains about half of all known lygaeid species. Most Rhyparochrominae forage amongst litter on the ground, and many appear to subsist almost entirely on fallen seeds (Sweet 1960, 1964a, b). Most other phytophagous Lygaeidae forage predominantly on vegetation.

Although lygaeid bugs are unfamiliar to most people, some are quite well-known pests. For example the 'strawberry bug', *Euander lacertosus,* is a widely distributed ground-foraging lygaeid that is not only an economic pest of strawberries (Slater, 1976), but can seriously retard forestry seeding operations in southeastern Australia (Cremer, 1966). Similarly, the Rutherglen bug, *Nysius vinitor,* is a common pest of fruit and vegetable crops throughout Australia, and can occasionally cause serious damage (Kehat & Wyndham, 1972).

In comparison to many other insect groups, the taxonomy of Australian lygaeid bugs is known reasonably well (eg. Gross, 1962; Malipatil, 1978), but our knowledge of other facets of their biology is poor. Aspects of lygaeid biology have been reported for some regions, such as southwestern Western Australia (Slater, 1975, 1976) and southeastern Queensland (Malipatil, 1979), but there is little information available on the lygaeid faunas elsewhere in Australia, including the cool and wet southeast.

This paper describes the lygaeid bugs collected during a four-year study of seed-

Fig. 1. Examples of lygaeid bugs from Wilson's Promontory. A. *Neolethaeus* sp. (dorsal view); B. *Myocara* sp. (lateral view); C. *Pseudodrymus* sp. (dorsal view).

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eating insects at Wilson's Promontory National Park, 200 km southeast of Melbourne. Information is given on habitat and host plant preferences, and on seasonal changes in the foraging activity of ground-foraging species. The possible impact of seed-eating by lygaeid bugs on seedling recruitment in the Park is also discussed.

Methods

Lygaeid bugs were collected on an opportunistic basis on the ground and on vegetation (mostly on species of *Leptospermum, Eucalyptus* and *Casuarina)* throughout Wilson's Promontory from March 1981 to December 1984. More intensive studies were conducted at adjacent *L. myrsinoides — C. pusilla* heath and *E. baxteri* woodland sites (each *ca.* 0.25 ha) at Tidal Overlook, near Tidal River (Andersen, 1986). At each site, 18 baits of *Eucalyptus* and *Leptospermum* seeds, and 15 pitfall traps (7 cm diam, ethanol used as a preservative) were established to collect seed-eating insects, including lygaeid bugs. Baits were visited on six occasions over 24 hrs (four times during the day and twice at night) each month from March 1981 to February 1982, and pitfall traps were operated over a 48 hr period each month from July 1981 to August 1983. Ants were by far the most common seed-eating insects collected, and have been described elsewhere (Andersen, in press; Andersen & Ashton, in press).

A collection of all lygaeid species collected in this study is held in the Northern Territory Museum, Darwin.

Results

A total of 22 lygaeid species from 17 genera were collected throughout Wilson's Promontory, with 16 species (all Rhyparochrominae) foraging predominantly on the ground, and 6 on vegetation (Table 1). The genus *Myocara* was the best represented, with 5 species, all of which are undescribed. Two undescribed genera were recorded, from the tribes Dilompini and Lethaeini.

Nearly all ground-foraging species were found in heaths and woodlands, and, although these habitats were sampled more intensively than any others, they appeared to be the sites of maximum lygaeid activity. *Euander lacertosus* was noteworthy in that adults occurred in vast numbers on the ground immediately following a fire at a woodland site in the northern section of the Park, although they were absent beforehand. Since immature stages were not recorded until several weeks after fire, the adults must have colonized the site from elsewhere. *Euander lacertosus* has been recorded as an opportunistic colonizer of disturbed habitats, including burnt sites, elsewhere in Australia (Cremer, 1966; Malipatil, 1979; Slater, 1976).

Most lygaeids foraging on vegetation were found on *Leptospermum* flowers and fruit, and none were found on *Casuarina.* All are phytophagous, except for *Geocoris hakeae* which is a predator of other insects (Malipatil pers. comm.). The Rutherglen bug (*N. vinitor)* was extremely abundant on *L. myrsinoides* flowers at many sites during November and December 1983.

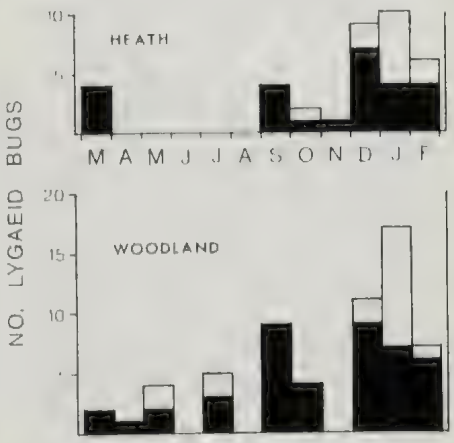

Fig. 2. Seasonal distribution of lygaeid bugs recorded at seed baits (shaded bars = total adults; open bars = total nymphs).

Table 1. Lygaeidae recorded at Wilson's Promontory. Members of the sub-family Rhyparochrominae are primarily ground-foragers, whereas all other species forage predominantly on vegetation.

SPECIES	HOST PLANT* /HABITAT
Artheneinae	
Dilompus robustus Scudder	Lm, Lj and Ll fruit
gen. et sp. nov. (Dilompini)	Eb fruit
Geocorinae	
Geocoris ?hakeae Eyles	Lm and Ew fruit
Ischnorhynchinae	
Crompus oculatus Stal.	Lj fruit
C. opacus Scudder	Lm fruit
Orsillinae	
Nysius vinitor Bergroth	Lm flowers
Rhyparochrominae	
Austroxestus australiensis Woodward	Tall Open forest
Brentiscerus australis (Bergroth)	woodland
Euander lacertosus (Erichson)	woodland (post-fire)
Fontejus collaris (Walker)	heath
Myocara sp. 1	woodland
Myocara sp. 2	woodland
Myocara sp. 3	heath, woodland
Myocara sp. 4	woodland
Myocara sp. 5	heath
Neolethaeus sp.	woodland
Paramyocara punctatum Woodward & Malipatil	heath
Porander scudderi Gross	woodland
Pseudodrymus sp.	woodland
Tomocoris sp.	heath
gen. et sp. nov. (Lethaeini)	heath, woodland
gen. indet. (Antillocorni)	woodland

*Lj = *Leptospermum* juniperinum, Ll = *L. lanigerum*, Lm = *L. myrsinoides*, Eb = *Eucalyptus baxteri*, Ew = *E. willisii*.

A total of 11 ground-foraging species were recorded at the adjacent heath and woodland sites at Tidal Overlook (Table 2). More individuals (50 vs 28) and species (10 vs 4) were found in the woodland than heath. The most abundant species in the heath were *Paramyocara punctatum* and the undescribed lethaeine, and in the woodland, *P. punctatum* and *Myocara* spp.

All lygaeids observed at seed baits were recorded at night, and most during the warmer months (Fig. 2). In addition to the 11 ground-foraging species, *Crompus oculatus, Dilompus robustus, Crompus opacus* and the undescribed dilompine were also collected at the woodland site, giving a total of 15 lygaeid species recorded there.

Discussion

Wilson's Promontory supports a rich lygaeid fauna, with a total of 22 species from 17 genera recorded in this study. Since 15 of these species were collected from a single site (the woodland at Tidal Overlook), there can be little doubt that more intensive collections at other sites would produce many more species. Several of the species, such as *Euander lacertosus, Brentiscerus australis, Nysius vinitor* and *Porander scudderi,* are widely distributed throughout Australia (Slater, 1976); however the high incidence of undescribed taxa suggests that many species

Table 2. Numbers of adult Lygaeidae at seed baits (B) and in pitfall traps (P) at adjacent heath and woodland sites at Tidal Overlook.

	HEATH			WOODLAND		
	B	P	Total	B	P	Total
Brentiscerus australis				4		4
Myocara sp. 1				12		12
Myocara sp. 2					1	1
Myocara sp. 3		2	2	8	6	14
Myocara sp. 4				3		3
Myocara sp. 5	1		1			
Neolethaeus sp.					2	2
Paramyocara punctatum	13	3	16	11		11
Porander scudderi					1	1
Pseudodrymus sp.				1		1
gen et sp nov (Lethaeini)	7	2	9	1		1
Total individuals	21	7	28	40	10	50
Total species	3	3	4	7	4	10

from Wilson's Promontory have a more restricted distribution.

What impact might seed-eating bugs have on seed supplies and consequently seedling recruitment at Wilson's Promontory? My unpublished studies of *Leptospermum, Eucalyptus* and *Casuarina* show that seed-eating insects can reduce seed production by more than 70%. However the internally-feeding larvae of moths, beetles and wasps seem to be far more important than lygaeid bugs. Similarly, it is highly unlikely that ground-foraging Lygaeidae are anywhere near as important post-dispersal seed predators as seed-eating ants, whose great abundance, high levels of activity and social organization enable them to remove large numbers of seeds from the ground (Andersen & Ashton, in press).

Although in most cases lygaeid bugs probably have little impact on seed supplies, at least in comparison to other insects, there might be some important exceptions. For example, *E. lacertosus* may seriously deplete seed supplies when it occurs in vast numbers at disturbed sites, such as after fire; and unusually large populations of vegetation-foraging bugs, as was the case for *N. vinitor* on *L. myrsinoides* flowers during late 1983, may substantially reduce seed production.

Acknowledgements

I am most grateful to Dr M.B. Malipatil and Dr T.E. Woodward who identified all the lygaeid species and also provided valuable comments on an earlier draft of this paper. Field work was conducted under a Permit granted by the National Parks Service.

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Insect Pollinators of *Hakea microcarpa* (Proteacae) at Bombala, New South Wales

BY GARRY WEBB*

Hakea microcarpa R. Br. is a small (<2 m) shrub, widespread at higher elevations through eastern Victoria and southern New South Wales, with scattered occurrences in South Australia, Tasmania and Queensland. At Bombala, in the New South Wales southern tablelands, it occurs on low-lying and swampy ground and commonly as remnant vegetation along roadsides in grazing land.

During December 1983 and January 1984, a small isolated patch of *H. microcarpa* along the Cann Valley Highway (ca. 20 km south of Bombala) was visited on three separate occasions to observe flower-visiting insects. Flowering was observed during mid-December but had ceased by 17 January (the last visit). All species of insect, mostly beetles, found on flower clusters, were photographed and subsequently captured for identification. Table 1 lists all species of beetles found on *H. microcarpa* flower clusters and presumed to be potential pollinating vectors.

Table 1. A list of adult beetles found on *Hakea microcarpa* flower clusters

Col: Buprestidae
Stigmodera delta Thom.
Stigmodera delectabilis Hope
Stigmodera moribunda Saunders
Col: Cantharidae
Cauliognathus pulchellus Macleay
Col: Cistelidae
Neocistela ovalis Blackburn
Col: Cleridae
Lemidia pictipes Blackburn
Col: Curculionidae
Aophoenemis rufipes Boheman
Cydmaea binotata Lea
Col: Lycidae
Metriorrhynchus rhipidius Macleay
Col: Mordellidae
Mordella promiscua Erichs.
Mordella sydneyana Blackburn
Col: Scarabaeidae
Phyllotocus rufipennis (Boisd.)

* Forestry Commission of New South Wales, P.O. Box 100, Beecroft, N.S.W. 2119.

The most common beetle on *H. microcarpa* was *Phyllotocus rufipennis* (Boisd.). These were found scrambling over flower clusters during the day and packed tightly within clusters after dusk. Few specimens of any other insect were observed. Interestingly, the three buprestids, *Stigmodera delta* Thom., *Stigmodera delectabilis* Hope and *Stigmodera moribunda* Saunders, were apparently specific to *H. microcarpa* since none were observed on any of the array of other flowering plants examined during this period (Webb, unpubl. data) *Stigmodera octospilota* (L. and G.) and *Stigmodera sexplagiata* (L. and G.), the most common buprestids found on *Leptospermum* spp. flowering nearby, did not occur on *H. microcarpa.*

The only published records of insects on *Hakea* flowers, that I am aware of, are those of Williams and Williams (1983) for *Hakea teretifolia* at Ingleside (N.S.W.) and Ku-ring-gai Chase National Park (N.S.W.). They listed *Cisseus notulata, Stigmodera sexplagiata and Stigmodera tricolor* as occuring on this *Hakea.* However, despite these records, it would appear from general examination of a number of *Hakea* spp. in the Sydney area, that *Hakea* may not be a common food plant. The *H. microcarpa* plants examined here produced copious quanties of nectar to which these beetles were attracted but is this a common phenomenon with *Hakea?*

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Observations on Some Jewel Beetles (Buprestidae: Coleoptera) in Western Australia

By T. J. Hawkeswood† and D. G. Knowles*

Abstract

Field observations are provided on bird predation on *Stigmodera (Themognatha) heros* Gehin and *S. (T.) tibalis* Water house and possible bird predation on *Julodimorpha bakewelli* (White). These observations were made during 1977 and 1978 in areas of Western Australia.

Introduction

Over the past several years a number of interesting observations have shed some light on the general biology and ecology of Australian jewel beetles (Buprestidae)(e.g. Hawkeswood, 1978, 1981a, 1981b, 1982, 1983; Hawkeswood and Peterson, 1982; Peterson and Hawkeswood, 1980; Williams, 1977, 1983; Williams and Williams, 1983). Further observations on Buprestidae from Western Australia (where a large number of species occur) are presented and discussed below.

Magpie predation on *Stigmodera (Themognatha) heros* Gehin and *S. (T.) tibialis* Waterhouse.

Stigmodera heros is one of the largest mallee-feeding species of jewel beetle. It has a wide distribution across the mallee sandplain habitats of southern Western Australia to north-west Victoria. The species has been recorded as a pollinator of *Melaleuca pauperiflora* F. Muell. (Hawkeswood, 1980). *Stigmodera tibialis* is one of the most common species of mallee-feeding buprestid in southern Western Australia and South Australia. Adults feed on nectar from *Eucalyptus cylindriflora* Maiden et Blakely (Hawkeswood, 1982).

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The following observations were made on 19 February, 1978 (by D.G.K.) while travelling through mallee sandplain vegetation dominated by *Eucalyptus foecunda* Schau., south-east of Hyden (32° 27′S, 118° 52′E). Two adult Western Magpies *(Gymnorhina dorsalis)* were observed tossing a large brown object between themselves on the side of the road. Closer examination revealed the object to be a large female *Stigmodera heros*. After the magpies had taken flight as a result of disturbance, the beetle was captured and closely examined. It was found to be alive and had suffered little body damage. During a quick perusal of the road verge, a loud buzzing sound was heard from a nearby thicket of *E. foecunda*. Further investigation revealed a specimen of *Stigmodera tibialis* which had lost five legs and was struggling on its back. It is possible that the beetle had also been attacked by magpies.

These brief observations suggest that during summer, when the larger buprestid species are on the wing, some may be subject to predation by magpies (and probably crows). However, the magpies may have difficulty in cracking the hard body coverings of the beetles and in keeping the large, rotund bodies between the smooth edges of the beak. The latter is analogous with attempting to cut a marble with a pair of scissors.

Observations on the remains of *Julodimorpha bakewelli* (White) scattered around dead *Xanthorrhoea* stumps.

On 1 October, 1977, at Mt. Peron (near Greenhead, 30° 07′ S, 09′ E) the whole or partly dismantled bodies of *Julodimorpha bakewelli* were observed (by D.G.K.) littered inside and around the remains of old stumps of *Xanthorrhoea*

preissii Endl. (Xanthorrhoeaceae). The grass-trees were growing abundantly in typical coastal *Banksia* heath vegetation on the upper slopes of Mt. Peron overlooking the adjacent coastline.

It is probable that the beetles were deposited at the base of the blackboy (grass-tree) stumps by small birds of prey which use the stumps as solid perches to facilitate easy capture of beetles flying (or crawling) over the surrounding heath. Many of the beetles had their abdomens removed and others had crushed bodies so that it appears that the birds fed on the buprestids when they returned to their resting posts on the blackboy stumps.

From the bird list given by Dell and Johnstone (1977) for the Cockleshell Gully area it appears that the most likely avian predator in the area is the Australian Kestrel *(Falco cenchroides).* This is a moderately common bird of heath and farmlands especially during October and February (Dell and Johnstone, 1977).

Acknowledgements

We would like to thank Mr. M. Peterson for suggestions and comments to an earlier draft written in early 1980 and to Mr. M. Powell for discussions on Buprestidae.

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Victorian Bird Report 1983

Published by the Bird Observers Club, Melbourne, Victoria. Available from the B.O.C. Centre, 183 Springvale Road, Nunawading, Victoria. ($2.50 plus 70 cents postage).

Since the publication of the first Victorian Bird Report (VBR) the list of contributors has risen from 120 in 1981 to 198 in 1983. This fine achievement was mainly the result of the light hearted 'harassment' by the Editor (Doug Robinson) of the numerous bird watchers who kept notable records of Victorian birds sealed away in their note books.

The 34 page report is attractively produced, sporting a very accurate drawing of a Lesser Yellowlegs on the cover by Kevin Bartram. The section dealing with Mechanics of the VBR on p. 4 explains how records received are vetted by the Editor and where necessary by an advisory committee. Some records of more common species are excluded to comply with the aims of the VBR to provide an annual summary of records which contribute to the knowledge of the Victorian avifauna.

The vetting process I believe is particularly useful in preventing the inclusion of dubious or erroneous records, often a product of over enthusiastic attempts at identification, or inexperience. This process is further strengthened by the assistance of five Regional Organisers who have intimate knowledge of the avifauna in their part of the State.

The systematic list covers 223 species and is punctuated with three mouth watering photographs, one of a Plains-wanderer (a rare elusive breeding species) and the other two detailed studies of a Ruff (a rare migrant wader). Highlights of the 1983 report were records of three new species for the State. Providence Petrel, Northern Shoveler and Lesser Yellowlegs (the latter also being the first record for Australia). Many inland species were recorded, such as Australian Pratincole, Black Honeyeater and Orange Chat, probably a legacy of the 1982 drought.

With the publication of three VBR's some tentative comparisons both between years and between species can be made, though like all bird reports where data is not collected systematically at a prescribed number of sites the quality and quantity of data provided is related to the number, distribution and skill of the bird watchers contributing. Nevertheless the information collected has augmented existing knowledge of the status and distribution of some species. For example it seems that species like the Sooty Owl are more widespread and Australian Bustards more frequent visitors than previously realised. The inland status of several species of wader is also becoming better established.

The only criticism is the availability of the report. The VBR as a separate publication is often overlooked by members of bird clubs and other individuals interested in birds, especially as publicity for the VBR seems somewhat limited. Circulation of the report would be greatly improved if it was published as an issue of the 'Australian Bird Watcher' and therefore subscribers to this journal would automatically receive a copy of the VBR. An example of this is the 'NSW Bird Report' which is incorporated into an issue of 'Australian Birds'.

The 1983 VBR is the last to be edited by Doug Robinson who is retiring due to the pressure of other commitments. It is hoped the momentum gained by his dedicated work as Editor is carried on by his successor and that support given by Victorian bird-watchers is maintained to enable this valuable publication to continue and become a permanent and comprehensive record of bird observation in Victoria.

— R. S. Brown

Report of Excursion to Rotamah Island Bird Observatory — August 31st to September 6th, 1985

By Elizabeth, K. Turner

Rotamah Island is a sand island, some 4.5 kilometres south-west to north-east and ½ to 1 kilometre wide, situated behind the thin barrier of coastal sand dunes of the Ninety Mile Beach and the East Gippsland Lakes, it lies seaward of Sperm Whale Head (see map). The coastal reserve is administered by the National Parks Service and the Bird Observatory is rented by the Royal Australasian Ornithologists Union. There are two resident wardens, Isobel Crawford and Tony Howard, who made us welcome at the old farmhouse, which is labelled "Residential School of Natural History" and has accommodation for 20 persons in five bedrooms.

The F.N.C.V. party consisted of three persons only. We approached the Island via Rosedale and Loch Sport and then along a sandy bush track through white flowering *Thryptomene* to Trapper Point on the south-east corner of Sperm Whale Head where we crossed a narrow portion of Lake Reeve by dinghy powered by an outboard motor.

In front of the farmhouse is a green sward gently sloping to the Lake on which grey kangaroos and emus with striped chicks graze, mainly in the late afternoon. A large wombat had made a burrow under the side verandah and delighted us with his frequent sortees into the back yard. There are more than 600 kangaroos on this small island many with young in the pouch, and also echidnas, one gave us an excellent sighting while it was digging holes in the sand dunes.

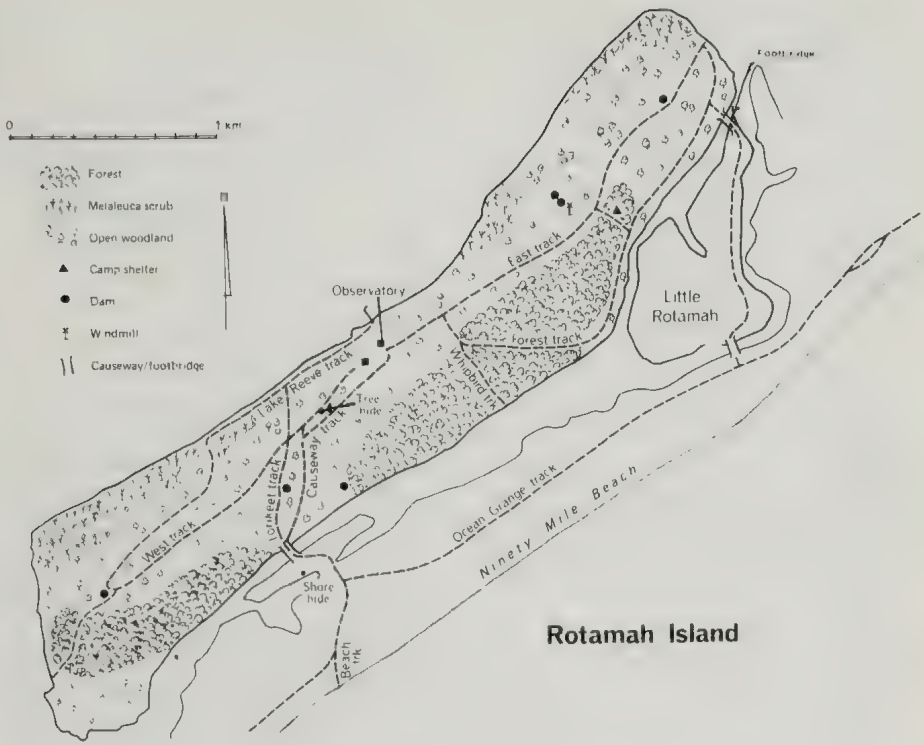
One morning a school of dolphins, accompanied by diving Terns gave a display about 100 yards off shore in Lake Reeve and the birds were a constant source of interest. Each night the wardens recorded the bird count which included dozens of black swans, pelicans, Little Pied and Black Cormorants, ducks, Hoary-headed Grebe, Chestnut Teal, Mountain Shell-duck, as well as Rainbow Lorikeets, Crimson and Eastern Rosellas, Cuckoos, Whistlers and Noisy Miners, one of the latter named Maurice seemed to be the only semi-tame animal on the island; he would come warily on to the verandah for bread crumbs.

There was a magnificent specimen of Gippsland or Forest Red Gum (*E. teriticornis*) in front of the house and several fine Mahoganys *(E. botryoides)* at the back. The Gippsland Manna Gum (*E. pryoriana*) is present and seems acceptable to the koalas introduced on to Sperm Whale Head, there are also specimens of *E. willisii,* named after our own D. J. Willis (one grows outside the Loch Sport bakery).

The island is largely covered with melaleuca scrub and with large flowering bushes of *Monotoca elliptica,* the Tree Broom Heath, one bush at least 15 feet high; the coastal beard heath (*Leucopogon parviflorus*) was also in full flower.

Everywhere the brilliant gold of wattles enlivened the bush, Sallow wattle (*A. longifolia*) and *A. genistifolia* (previously *'diffusa')* and Prickly Moses *(A. verticillata*) were the most profuse species. *A. mearnsii,* the late black wattle had been attacked by a "fire-blight" beetle and the defoliated branches appeared as a bright russet-brown. Rounded noon flower (*Disphyma australe*) with shining magenta flowers provided mats across sandy and salt-marsh areas, along with climbing Bower Spinach (*Tetragonia implexicoma*).

Clematis microphylla flowered luxuriantly over the shrubs and underneath we found flowers of *Ptero-*



Rotamah Island

stylis curta, the blunt greenhood; *P. nutans,* the nodding greenhood; *P. nana* the dwarf greenhood; *P. alata* the striped greenhood; *P. pedunculata,* maroon-hoods; *Acianthus exsertus,* the gnat orchid, and the Common Bird orchid *(Chiloglottis gunnii).*

There were splashes of colour in the bush from the particularly deep violet of the *Hardenbergia* and the lighter pinky-mauve of the *Indigofera australis.*

At first we were pleasantly surprised at the warmth of the climate after leaving the cold of Melbourne, but after a couple of days,rain clouds gathered and we recorded 8 mm of rain overnight. The walking tracks had been recently cleared, a new jetty was being constructed, also the bird hides had been refurbished in anticipation of a visit in October from the Prince and Princess of Wales.

A causeway (where a calamanthus wren sang at sundown) connected Rotamah Island to the Ninety Mile Beach, where we could always see gannets fishing and occasionally albatross, one party saw a raft in the ocean composed of thousands of Fluttering Sheerwaters, also skuas, terns, oyster catchers and sometimes penguins were seen. There was a constant change of life from the outer edge of the surf zone to the edge of the coastal sand dunes.

Delicate coloured bivalve shells were abundant on the sand and their whitened ancestral specimens lay thickly about the ancient aboriginal midden sites in the dunes, in fact on one occasion when we were "bushed" these ancient bygone indiginees led us down a non-used sand blow path through thickets of coastal ti-tree until we were able to pick up the path

made by a modern indiginee — a wombat whose track led us back through swamps and thickets to the Ocean Grange track. We marvelled at the enormous height, bulk and flowering of the *Banksia serrata* and *B. integrifolia* trees along this track.

Cloven hoofed tracks puzzled us at first until we saw Hog Deer (introduced from India) and their fawns; these with foxes, rabbits and (as Isobel complained) rats appeared to be the only introduced placental mammals (except Man) on the island, otherwise the island is a delightful native reserve easily accessible from Melbourne, providing a phone call to the Warden (051) 56 6398 is made and the boat trip arranged.

Report of Excursion to New South Wales 15-28 September 1984

The weather was bleak and overcast as 23 Field Naturalists — seven of whom came from the Latrobe Valley Club — climbed aboard McKenzie's coach with Marie and Gordon at the helm, and set out on what was for many of us a voyage of discovery to some of the N.S.W. national parks.

Our lunchtime stop found us in the ironbark forest at Rushworth — masses of *Acacia acinacea* — the gold-dust wattle — so typical of the area, made a bright note amid the dark trunks and we were delighted to find several orchids — waxlips, donkey, greenhoods and pink fingers, sundry peas and many other small treasures.

We crossed the Murray River at the historic old riverport of Echuca and during the brief time there our "birdo" members recorded many birds, amongst them their first sighting of the trip of Yellow Rosella.

Our destination for the night was Deniliquin so we had to press on. The countryside was so green after an exceptionally wet winter, and waterbirds of many species were much in evidence wherever there were small lakes and swamps.

Next morning saw us heading for West Wyalong — the day still overcast and chilly but fortunately fine. A short stop at Jerilderie gave us the opportunity to look for birds in the pleasant little Apex park with its lake. Blue-faced honeyeater, rufous songlark, grey fantail and black-faced cuckoo shrike were among those noted. Driving on through irrigation country — chiefly rice — we crossed the Sturt Highway and presently were in red gum forest at Willbriggie where many galahs, ravens and peaceful doves were seen as we sped along. Thence to Griffith and a quick visit to Cocoparra National Park and Mt Binya. We had time only for a brief "botanising" but it was a joy to see much *Calytrix tetragona, Ziera* sp., *Pomaderris, Stypandra glauca* and a *Phebalium* sp., as well as several orchids and creamy festoons of Wonga Vine *(Pandora pandorana).* The roadsides were massed with magnificent wattles which were at their perfect best. Evening found us at a West Wyalong motel, and heavy rain fell during the night.

Fortunately this had eased somewhat next morning and as we passed through Forbes we recalled its historic connections with Henry Lawson and bushranger Ben Hall. Then on through Parkes where in the distance we could see the giant radio telescope.

A short time was spent viewing the old open-cut gold mine at Peak Hill, the scene of great activity in the 1890s. These huge holes were gouged out by hand — and one can only admire the fortitude of these early miners. The colours in the walls of the mine, due to iron, calcium, magnesium and other trace elements, are quite remarkable. Here were several peas,

the golden top wattle *(Acacia tindalea)* mint bush *(Prostanthera denticulata)*, western urn heath *(Melichrus erubescens)* and numerous other little plants, all gradually recolonising the heaps of rubble from the mine.

We arrived at Gilgandra on the Castlereagh river where we were to spend the next three nights at Silver Oaks motel — a cheerful friendly place. More rain during the night and in the morning we set off along a gravel road towards the distant Warrumbungle Mountains and the National Park. As we drove steadily along we encountered a sticky slippery patch of road and alas, we slithered sideways like a crab into the gutter — oh dear! However by dint of much gathering of dried grass on the road verges, and what could be found in the way of dead sticks, and cheered on by encouraging heaves and grunts, we eventually helped our heavy vehicle regain the crown of the road. Just then we were joined by a kindly neighbourhood farmer on his tractor. He'd heard our labouring and in typical country fashion had come to help. Happily we were safe but assured him of our appreciation.

The Warrumbungles have a fascinating geological history. It is generally thought that the area was the scene of much volcanic action some 13 million years ago, though the underlying structure is much older. The cores of the volcanos appear now as strange and dramatically shaped great rocky pinnacles. The misty wet weather prevented us from seeing the park in its full glory but we were delighted to find so much in flower. The botanical list, thoughtfully made available to us at the Information Centre, records some 18 species of *Eucalyptus* and 28 species of *Acacia* for the area. Many of these were in bloom — notably *Acacia doratoxylon* (Currawang), *cheelii* (Motherumba), *decora* (Western golden), *implexa* (Hickory), *spectablis* (Mudgee) and *triptera* (Spurwing). Most beautiful River Oak *(Casuarina cunninghamiana)* lined the streamsides and on every hand were flowers in profusion. The rain put a stop to any thought of walking but we were able to drive to points of interest, notably the Siding Springs Observatory which contains what is considered to be the most advanced telescope in the southern hemisphere.

The John Renshaw Parkway, principal roadway through the Park, took us back via Coonabarrabran on our homeward journey to Gilgandra. The rain had eased and we were able to make a detour to visit the Gilgandra Flora Reserve which for many of us was the highlight of a very interesting day. This 12 acre reserve is an example of the vegetation which once covered the countryside — now cleared for agriculture. The rare pink *Phebalium - Pnottii* — was at its loveliest and mixed with blue *Dampiera*, pink *Calytrix*, wattles of various species, *Cryptandra*, and many other small shrubs, was a beautiful sight. This reserve is in the care of a very dedicated and knowledgeable lady — Mrs Anderson — whom we were fortunate to meet.

Luckily our second day, though overcast, was not so wet and once again we set forth to the Warrumbungles, carefully avoiding the hazardous route of the previous day. This time we were able to walk along Burbie Canyon — a pleasant gully where we saw a great variety of plants notably grevilleas, Correa, Phebalium, *Indigofera*, *Swainsona*, hopbush, blackboys, *Pimelia*, several wattles, *Hovea* (almost finished flowering) *Clematis* and much else. The profusion of blossom provided food for a host of birds and striped honeyeaters, little lorikeets, and noisy frairbirds were among those recorded. Some of us watched a spotted pardalote very busy at its nesting burrow in a creek bank.

We had received an invitation to visit the Gilgandra Observatory created as the retirement hobby of a quite remarkable local citizen who had built almost all of it himself. Unfortunately the evening was

overcast and drizzling but our host was able to demonstrate how the domed roof could be rolled back to reveal the night sky, and explained how his telescope functioned. His observatory housed a considerable collection both of historic relics and natural history specimens and we were particularly fascinated by a collection of plant specimens preserved by Mrs Anderson — the guardian of the Flora Reserve — in a very special way. These flowers were first dried by being "immersed" for some days in powdered silica gel, then fixed with hair spray and finally mounted individually in special display cases. The three dimensional effect was a vast improvement on the customary flat "pressed specimen" and this idea is well worth remembering.

Day 6 and time to move on again. The weather still wet and cold. Passing through Coonabarrabran once more we followed the Newell Highway and reached the Pilaga Scrub — an area noted for interesting plants. We were not disappointed. Wedding Bush *(Ricinocarpus), Boronia, Zieria, Dampiera,* peas of many species, masses of wattle and a multitude of wee surprises greeted us as we alighted for our lunch. Birds were very busy and among those recorded were the white throated and the speckled warblers.

Narrabri was reached in late afternoon — a pleasant town of some 7500 people. The handsome early Courthouse was an interesting landmark and next door was the Police Headquarters, a modern two storey building whose wide eaves provided convenient shelter for a host of the bottle shaped nests of Fairy Martins!

Day 7, our first really fine day and we were soon on our way to Kaputar National Park which lies some 53 km to the east of Narrabri in the Nandewar Range. This area is also of volcanic origin and contains deep gorges and high pinnacles. As much of the Park is over 1000 metres in elevation, there is quite a range of plant communities. En route we stopped at a special roadside spot known to Gordon, to search for orchids and among the several species found was the rarely seen *Caladenia filamentosa* in perfect flower. Our camera buffs were kept very busy.

The Park Ranger very kindly showed us several points of interest and took us to the summit of Mt Kaputar (1524 m) from which a magnificent 360° view is obtained. As we sat among the boulders, surrounded by tufts of snowgrass, beard heath and various peas, a majestic wedgetailed eagle soared overhead, just completing the picture.

Next day we were off again — travelling through a gap in the northern end of the Nandewar Range and passing into a beautiful valley. Here Gordon took us to a special glacial area on Rocky Creek where many centuries ago a great glacier deposited countless thousands of pebbles as the ice melted. Subsequently these pebbles became compressed to form conglomerate rock and today appear as huge boulders with most beautiful subtle colouring and patterns.

Tamworth, a town of some 34,000 population, situated at the foot of a high hill, was our next overnight stop. We drove to the summit (541 m) and admired the extensive views from the Oxley Lookout, named in honour of John Oxley who explored much of that district in 1818.

Next day, Sunday, a beautiful blue morning, saw us journeying along the New England Highway, through a rich green valley. We had been told of the "Burning Mountain" near Ardgeen so of course felt we should investigate. Leaving our coach at the roadside we climbed a stile and set off along the little track to walk the 2 km and eventually after much up and down we arrived at this strange phenomena. Smouldering apparently for centuries, it was seen by explorer Sir Thomas Mitchell in 1829. The area now has a raised walkway erected over it, for the safety of sightseers, a most sensible precaution in this potentially hazardous place.

Arriving at Singleton somewhat ahead of our schedule, we were able to visit the remarkable little museum which was filled with many historic treasures and manned by two enthusiastic representatives of the local historical society. From Singleton we took the Putty Road which wound its way through a gap in the range. The vegetation had quite a rainforest appearance and the lovely little stream which flowed beside the roadway was lined with *Tristania, Casuarina,* wattles, and numerous other species whilst Wonga vine, *Clematis* and *Kennedia* scrambled through the shrubs and birdsong filled the air. A small electrical bother in the coach necessitating a stop, gave us a good opportunity to botanise and birdwatch.

We continued on, stopping here and there to wander in the forest, each time finding something we'd not previously seen. On one such occasion a wonderful patch of tiny waxlip orchids, *Glossodia minor,* a "first" for many of us and at another stop were waratahs in bloom. And so we eventually arrived at Windsor on the Hawkesbury river, a large historic town, then Richmond with its RAAF base. Crossing the Nepean River we began the climb into the Blue Mountains to Katoomba where we were to stay for two nights. The weather was fine fortunately and we visited many notable lookouts and admired the wonderful dramatic cliffs and gorges and valleys.

We retraced our way down the mountain, passing through Camden and Picton till we arrived at the picturesque little village of Berrima for our lunchtime stop. The Federal Highway took us in to Canberra where we were able to have a quick walk in the Botanic Gardens. Birdsong filled the air and the flowers were magnificent. We had time to visit the lookout tower on Black Mountain and view the full extent of Canberra in the late afternoon light. Before departing next morning Gordon took us for a familiarisation drive around the city of beautiful trees. Just as well we'd seen the view the previous evening for once again the skies were overcast and visibility poor. A quick visit to Wagga and The Rock and so to Albury for our final night.

Back into Victoria and home via historic Beechworth. Our more than 3500 kilometre journey had been most interesting and memorable — each day something new, something different.

Our "birdo's" recorded about 120 species, our botanists had been charmed with the splendid Spring display, due in no small part to the wet winter, and everyone had thoroughly enjoyed our trip.

Warmest thanks to Marie and Gordon

G. Taylor and others

FIELD NATURALISTS CLUB OF VICTORIA

Reports of recent activities

General Meeting Monday, 9th September

This was the Club's annual Members' Night, and a number of members spoke briefly on a variety of subjects.

First was Mrs. Elsie Costermans who spoke about a recent F.N.C.V. General Excursion to Fraser Island. The island is made of pure sand with only a few rocky outcrops, and yet it supports an amazingly diverse flora including tall forests. There is a huge quantity of fresh water on the island, including several large lakes and many streams flowing out to sea. Much of this fresh water reaches the island through underground channels from the mainland. Mrs. Costermans showed slides of the island and included some of the beautiful plants they saw in bloom including a beautiful white flowered *Hovea.*

Mr. Andy Blackburn, who was on the

same excursion, continued the discussion on Fraser Island. His slides included aerial views of the island and close up photographs of plants including the King Greenhood.

Mr. Lance Williams then spoke about some recent activities of the Mammal Survey Group including surveys carried out in the Big Desert Wilderness, in East Gippsland and a Rock Wallaby survey in the Grampians.

Following on from this, Miss Wendy Clark exhibited slides which she had taken while on M.S.G. camps in the Big Desert. She showed many different wildflowers, a pigmy possum, several different reptiles including a Bearded Dragon lizard and a Bardick snake, spiders, birds and beautiful landscapes.

Mr. Geoff Law of the Australian Conservation Foundation spoke last on the Woodchipping Industry in Australia but particularly in Tasmania. He spoke of the long-term damage that is being done to the forests of Tasmania. Much of the mature eucalypt forest and cool-temperate rainforest is being cleared to make way for production forests. The A.C.F. is fighting to have areas of different mature forest types preserved as National Parks and to encourage the planting of trees for timber production on derelict farms. The Federal Government is at present deciding whether to continue Tasmanian export licences and later will decide whether to grant them to Victoria and Queensland. Mr. Law stressed the urgency in writing to the government in opposition to Woodchipping.

Exhibits

— Under microscopes: Pollen from Blackburn where it is being released in huge quantities. Probably from a species of pine.

— A marine mite. Unlike freshwater mites, which are usually very active and brightly coloured, these are rather slow and dull. Found occasionally on brown seaweeds.

— An uncommon little hydroid, *Rathkea,* from Black Rock which has been grown in culture since 1982.

— Eggs of the nudibranch, *Doriopsilla carneola.* The larvae can be seen to have reached the veliger (planktonic) stage which this species passes through before hatching.

— Skeleton shrimps, *Caprella,* common on intertidal brown seaweeds. (Mr. D. McInnes).

— Morel fungus from Mt. Kooyoora State Park (Mr. W. Ashburner).

— From Queensland and Fraser Island: Seedpod of Black Bean, *Castanospermum australe* and seed of Crab's Eyes, *Abrus precatorius* Pumice and fulgurite (formed when lightning strikes wet sand) and part of a python's skin. (Mr. A. Blackburn).

— Brush-tailed Rock Wallaby scats from the Grampians. (Mr. L. Williams).

— A mushroom, *Cortinarius castaneofulvus* from Kyneton. Books, including Gilbert White's "The Illustrated Natural History of Selbourne" and photographs of Selbourne. (Mrs. S. Houghton).

— An article on the Pigmy Possum in the Aug/Sept. 1985 issue of Action Outdoors magazine which she had authored. (Miss W. Clark).

Nature Notes

— The Club's Cosstick Reserve at Maryborough which was ⅔ burnt by bushfire last summer was visited. It is a rich area botanically and seven species of orchids were seen flowering. The Maryborough F.N.C. was thanked for the work they have done there including the refencing of the reserve.

— A blackbird with a white wing and rump seen at the Shrine. (Mr. W. Ashburner).

— In 1982 there was a pure white Blackbird in St. Kilda Rd. There seems to be an aberrent population in this area. (Mr. I. Faithfull).

— Ploughshare Wattle *(Acacia gunnii)* starting to flower at Kyneton. (Mrs. S. Houghton).

— Duck and Sun Orchids flowering in Southern Queensland in August. (Miss. M. Allender).

General Meeting

Monday, 14th October

The Speaker for the evening was Dr. Neil Hallam of Monash University Botany Department who spoke on "The Biology of Macquarie Island."

Dr. Hallam visited Macquarie Island, a subantarctic island situated to the south-east about half-way between Tasmania and Antarctica, in the summer of 1983/84. He went as a biologist on an Australian National Antarctic Research Expedition to study and collect seaweeds, particularly the Giant Kelp, *Durvillaea antarctica.*

After introducing the geological history of the island, Dr. Hallam went on to discuss theories on the origins of its flora which has affinities with other circumpolar islands, the alpine flora of Australia and New Zealand and with South America.

In spite of the remoteness of the island, man has had a large impact on its flora and fauna since it was discovered in 1810. The demand for seal skins and oil in the nineteenth century led to the hunting and near extermination of fur and elephant seals by sealers, who then turned to the penguins for their oil. Although this killing stopped in 1919, there are still very few fur seals on the island. The sealers also damaged populations of other species by eating them and by introducing other animals such as cats, rats, mice, goats (now exterminated) and rabbits which have been particularly damaging to the island's ecology.

Dr. Hallam illustrated his talk with slides of the island and its flora and fauna and then showed a video tape which he had taken while there.

The film included footage of a helicopter trip around the island, penguin rookeries and his work with *Durvillaea antarctica.*

D. antarctica, which, with an air-chambered frond up to 10m long, is by far the largest plant on the island, was seen floating in dense, tangled rafts upon the waves.

Exhibits

— Under microscopes: Several polychaete worms including a terebellid and the tube-worm *Galeolaria* and some small sea anemones. (Mr. D. McInnes).

— A fan-fungus from eastern N.S.W. (Mr. U. Bates).

— Small green ostracods from a backyard pond in Heidelberg. (Mr. R. Ward).

— Peacock Ore (Copper Pyrite) and Agate with tiny pieces of Opal in it. (Mr. R. Faragher).

— Very large cones of *Casuarina stricta* from the Mornington Peninsula. (Mr. T. Sault).

— Half-eaten candles and scats left by Brush-tailed Possum and rat. (Mrs. S. Houghton).

Nature Notes

— At the Club's Cosstick Reserve at Maryborough many plants are regenerating after last summer's fire. *Glossodia, Diuris, Caladenia* and *Thelymitra* species are in flower. (Miss M. Allender).

— Also seen at Maryborough, "The Big Reef", the largest quartz reef in Australia, near the old goldfield of Amherst. It is now a flora and geological reserve. Aboriginal wells were also seen in the area. (Mr. D. McInnes).

C. M. Shankly

Field Naturalists Club of Victoria

In which is incorporated the Microscopical Society of Victoria

Established 1880

Registered Office: FNCV, c/- National Herbarium, Birdwood Avenue, South Yarra, 3141.

OBJECTS: To stimulate interest in natural history and to preserve and protect Australian fauna and flora.
Members include beginners as well as experienced naturalists.

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